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SEQUESTRATION ANÆMIA IN BRAIN AND SKULL SURGERY.

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OF all the operative causes of shock, admittedly the first and chief is hæmorrhage. Indeed, it has been said by able clinicians that shock is only another name for hæmorrhage.*

The older a surgeon the greater becomes his respect for a drop of blood.

It seems strange that careful as we all are to apply this principle in cutting work upon the limbs, it has apparently been overlooked (as to cording) elsewhere. For example, prior to any bloody operation whatever upon an extremity, we elevate and accumulate in the trunk, neck and head, by gravity, and sometimes also by centripetal massage, most of its blood; and then by cordage near the trunk maintain anæmia during the cutting. But what surgeon about to operate on however vascular a field of the head, the neck or the body, ever applies this same principle—and to avoid hæmorrhage accumulates blood in the extremities? Nobody, for this purpose, so far

* Crile on Surgical Shock, p. 138. (Explaining, however, that in reality hæmorrhage may be only one important factor in shock causation.)

as I am aware. And yet if wise in the one instance it is (at least as to preventing bleeding) obviously so in the other. To be sure we cannot deprive the other parts of blood to anything like the same degree that we employ in dealing with the members. Nevertheless, experience shows that we can with entire safety withdraw into the limbs some quarts of the whole bulk which constitutes one-thirteenth of the individual's weight. We can sequestrate before operation and retain in the limbs by cordage enough to make a striking difference in loss of blood from the operative field; enough, indeed, as the writer has convinced himself, to constitute in many cases the difference between life and death, between shock and absence of shock, in a gravely severe case.

This temporary bleeding, so to call it, into the patient's own extremities, is controlled as to degree, by the finger of an assistant upon the pulse. Its original volume and force being estimated, the sequestration proceeds until there is a plainly noticeable softening and lessening of tension. At this point begins the operation; and every cut vessel spurts less than otherwise would be the case. Indeed, were we unwisely to carry the plan to its limits, hardly any hæmorrhage would occur, but the patient's heart would beat so feebly as to cause him to faint away. Many a case, for instance, of attempted suicide from cut-throat has lived because of this, firm clotting occurring meanwhile at the mouths of the severed vessels. And as to effect upon respiration, this is proportionate to the extent of the bleeding, whether actual or into the patient's limbs, the breathing being always both accelerated and deepened.

But of course no such extreme is advised: simply a noticeable degree of pulse softening. If we reduce by even a moderate amount the quantity of blood otherwise surely lost, the gain in safety is obvious. Should the anæsthetist observe a tendency toward cardiac weakness it is easy almost instantly, by release of cordage, to produce a distinct improvement both as to force and number of heart beats.

This report is in the nature of a preliminary one. I am

experimenting as to whether by the circumference of the limbs taken before accumulation and again later on we can estimate the relative amount of blood withdrawn. It is possible that by testing the blood-pressure before and after withdrawal into the limbs, using by choice the Riva Rocci apparatus with Cushing's improvements, the assistant may reach more accurate estimates than thus far have been attained. However, in no case out of many (including therein work upon the neck, chest, abdomen and pelvis, as well as a much smaller number upon the skull), has the writer thus far cause to regret using the plan. It is not, then, because of simply theoretical advantages that it is now brought forward, but because it has practically been found a means of safeguard and reliance. And it can now be spoken of in terms which at first would not have been justifiable.*

The technique is as follows: A towel folded lengthwise is wrapped about each thigh very close to the trunk, and upon this the rubber tube is tightened. The towel serves in a measure to prevent subsequent discomfort, by spreading the pressure over a wider area. The degree of tightness is quickly learned by practice. It must nearly stop the venous but not the arterial current. Quickly the limb distal to the tourniquet grows dusky in color and there is obvious swelling also. After from five to ten minutes, according to the tightness of the cord, the softened pulse will indicate that we are ready to proceed with operating. The congested limbs are, however, first warmly wrapped, and hot-water bags placed about them.

In case the effect of the major anæsthesia is feared, in a given instance, these steps may be taken with a conscious patient, in order to form a reserve-guard of pure blood. And if then during operation failing respiration or other cause seem to justify it, removal of cord and elevation of limb or

* The writer distinctly states that he makes no claim for originality as to cording for the arrest of *accidental* hæmorrhage, either surgical or medical. As to the latter he would again call attention to a much neglected subject. See his paper in the Proceedings of the Surgical Society of the New York Academy of Medicine, Nov. 9, 1891.

limbs will pour quarts, literally, of fresh blood into the narcotized, and the patient will awaken almost at once.* But as a rule, to avoid discomfort, nothing is done until the subject is asleep.

When at first the writer began experimenting in blood sequestration a less simple plan was thought essential. Two limbs being swollen, the cord was tightened so that no further blood could enter, nor any escape. So far as a study of literature could guide, no case was discovered where absolute stagnation of healthy blood within a healthy limb for as short a period as a half hour had been followed by gangrene; but for safety, after fifteen minutes (if the operation must be longer) the assistant, trained to this purpose, began cording the remaining two limbs, almost at the same time commencing to release those first constricted; and in a long operation this shifting from arms to thighs, and back again, was done repeatedly. But after a time it seemed that we might obtain equally good results with less trouble; and since then the tube has been left so placed, as to degree of tension, that continually some blood enters—for the pulse is not wholly shut off—and of course some blood also escapes into the trunk. Only in case the limbs grow excessively swollen, or the pulse demands a change, is the tension altered during the operation. In a few plethoric individuals I have used constriction of all four extremities at once in this way. But generally cording the lower ones only—at the groin—has sufficed to accomplish much good in the way of blood saving.

Obviously, the ultimate return of so much blood into the general circulation ought not to be accomplished instantly. For the sake of the heart, the cords should be loosened rather slowly, taking nearly as long to release as to accumulate the blood.

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* Of course for this purpose the idea is not at all new. It was first suggested (*re* anæsthesia, by Dr. David Webster in the N. Y. Med. Journal in 1887, and was tried by the writer within a month later. See also Atlanta Med. and Surg. Journal, Aug., Sept. and Oct., 1897,—articles upon Anæsthesia.

The question naturally arises at this point whether, as this is done, the restoration of the usual pressure will not be accompanied by so much spurting from a myriad cut vessels—if the field be large—that finally little would really be gained in saving of blood. Undoubtedly this would be the result if nothing further were to be suggested. But as a regular part of the procedure under discussion we must, before releasing the tourniquets, clot firmly the blood in the mouth of every divided vessel by the following step—*to be considered the necessary corollary of what has gone before, and always to be used after it.* I refer to an application of gauze sponges wrung dry, with the rubber-gloved hand, out of actually boiling water brought at this moment to the operating table. Not "hot" water, but water at 212 degrees F. No one need fear ill results to even the most delicate tissues of the human body from a few seconds' firm application of gauze at this degree of heat—the brain perhaps excepted.* And, in consequence, not only is bleeding prevented, but the entire raw surface turns white from coagulated albumen, sterilizing it if it was not sterile before. And thereafter, if contaminated by ichorous

* The author has not as yet tested upon animals' brains the effects of brief contact at a boiling temperature; but as to nerves has done so, and they are not injuriously affected, if only a few seconds elapse in such contact. It was only after such experimentation that the following operation was performed. Upon October 11, 1906, at Dr. John A. Wyeth's clinic at the N. Y. Polyclinic Medical School the author excised from the left side of the neck of a man of thirty a cancerous growth so extensive as to require the removal, in the mass, of practically the entire length of the deep jugular vein. The pneumogastric nerve was saved. During manipulation several suppurating lymph-nodes ruptured, infecting the large wound, which was first cleansed by irrigation as usual, then dried, and filled for fifteen seconds with water actually boiling when taken from the fire, across the room. As in the dog, so here, an instant effect was noticeable. The patient's breathing was made much deeper and more rapid; also the heart's force was distinctly increased and the frequency was somewhat lessened. These effects upon the pneumogastric were observable for from three to five minutes. The wound was closed except for a narrow gutta-percha tissue drain introduced at the lowest point through a counter opening above the shoulder; and it quickly healed by primary union throughout. No subsequent adverse effect upon the nerve was observable. In repeated cases the writer has used the steaming

pus or septic fluids from the mouth or bladder, for instance, we are reasonably safe from danger of extension of such infection—very much as the surgeon feels regarding such a risk when once his wound is covered with healthy granulations.

Of course it is necessary, in order to prevent blisters, to avoid contact with skin or mucous surfaces. And obviously a very long application might, so to speak, cook the flesh. But used as advised, the writer has never had cause to be other than pleased with the result of employing this very old but much neglected application of heat.

Since atmospheric pressure makes such a difference in the temperature of boiling water, at high altitudes such as Denver it would be necessary for the best results to use water heated under pressure.†

Among the advantages of sequestration surgery (if I may use this term, simply to avoid a long periphrasis, whenever in this paper I must refer to it) in brain work its striking lowering of intracranial pressure is not the least. Where a brain tumor is to be operated upon, for one example among a num-

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gauze pressed for a few seconds—or even boiling water—in direct contact with the deep jugular vein; the youngest, a baby of a year old, immediately following removal of tubercular lymph-nodes; this was a patient of Dr. William A. Ewing, of this city, who assisted. There were no objectionable results; the venous current was too rapid to permit of heat clotting—and the infected wounds healed per primam.

In the pneumogastric case just discussed the author ended by doing his starvation operation (excision of the external carotid and its branches, with paraffin plugging of the terminal two).

Dr. Wyeth, who was present, remarked to the class of graduate students, that for the kind and size of operation the wound had been dryer—there had been less bleeding—than he had ever seen before. This we quote simply as bearing upon the technique under discussion, for this operation was done with corded lower limbs.

† It may be suggested that heat so employed may well take the place of Harrington's fluid, as sealing cut lymphatics and bloodvessels without use of irritant chemicals. Also prior to use of Mosetig Moorhof's bone-cavity filling, it will stop bleeding without harm—instead of the use of dry air at burning temperature pumped in, which risks superficial necrosis from the presence of a red-hot point close to or within the bone cavity, meanwhile. Of course the cavity must next be carefully dried, before introducing Moorhof's filling.

ber, a great risk of sudden death is thus avoided. To quote Sir Victor Horsley *: "Moreover, all cases of increased intracranial tension (as is now well recognized) are liable to die at any moment of sudden paralysis of the respiratory centre. How often one sees this accident in cases of intracranial tumor who are only at the very last transferred for surgical treatment!" Crile,† too, names excessive intracranial pressure first among causes of collapse due to injuries or operations affecting base of brain and medulla.

Horsley objects to ether because it invites more hæmorrhage in brain operation. And yet, though advocating chloroform, admits its greater toxicity to nerve-tissue. He adds: "In the literature of the early days of cerebral surgery may be found instances of death upon the operating table, which I have no doubt were due to failure of the respiratory centre owing to a dose of chloroform having been given which, though perhaps not necessarily lethal in an ordinary case, was fully so to a patient whose bulb was hampered by previous tumor pressure." It must be obvious that the plan we are herein advocating is a distinct safeguard to some degree against the danger mentioned from each of these drugs, and from pressure. And, conversely, in brain operations where already the pressure is dangerous (as in instances just quoted) Crile's pneumatic suit would obviously add to the risk unless indeed both of the common or the internal carotids be controlled as he suggests.

It is important in connection with Horsley's paper to note his method (loc. cit.) of treatment of hæmorrhage during brain work of the kind chiefly annoying—venous and capillary oozing, due to chloroform asphyxia, which raises the intravenous pressure—he adds a stream of oxygen to his chloroform vapor. "It is interesting," he says, "to see how rapidly the bleeding stops as the color of the oozing blood changes from dark purple to bright scarlet. I frequently, therefore, during operation, especially toward the end, request

* British Med. Journal, Aug. 23, 1906.

† Surgical Shock, p. 151.

the anæsthetist to turn on the oxygen for this purpose as well as for the elimination of shock."

For this interesting and valuable discovery we are thankful; but as to the following from the same paper, it is perhaps not beyond a mild criticism: "When the brain is obviously turgid with congestion I always ask that the chloroform percentage should be raised for, say, a quarter to half a minute, to one or two per cent. This at once induces a convenient, proportionate, and of course temporary anæmia" (by causing a fall in blood-pressure). Plainly, as sequestration does the same thing, we have in it "the ounce of prevention," and no need to push chloroform at all.

In controlling arteriole and capillary brain hæmorrhage, Horsley's favorite plan is hot water irrigation at a temperature "which should not exceed 115° F. nor fall below 110° F." He fears that if 120° be used, heat coagulation of the cut surface of the brain would result.

During a very recent visit to the Mayos at Rochester, Minn., the writer found Dr. Charles Mayo employing what is in effect the same idea as his own, in otherwise very bloody work upon head or neck. He employs *gravity* sequestration, however, instead of cordage. His patient is seated in a nearly upright posture, and Dr. Mayo stands upon a stool in order to be high enough to reach the field of operation. Obviously if there are any objections to be offered to the plan by sequestration they apply equally here; but Dr. Mayo has had no reason to regret adopting this idea. However, were chloroform to be the anæsthetic chosen, the upright attitude would self-evidently be unsafe because of its effect upon the heart. It is for this reason that its employment by dentists in the dental chair has been followed by fatalities not otherwise explicable.

In addition to Horsley's and Mayo's ideas as to control of hæmorrhage in this operative field we must refer to the recent suggestion of Dr. George W. Crile, in his paper read at Boston last June, in which he advocated in addition to "a head-up inclined posture," and his rubber pneumatic suit, exposing

and applying temporary clamps to the common carotids; to be released as soon as the operation is completed. This last he also suggested in his work upon Blood Pressure.*

Thus far we have said nothing regarding a question which has doubtless occurred to all—namely, does sequestration-anæmia threaten shock?—depriving as it does, however, temporarily, the brain and heart of a considerable part of the blood.

The answer, based upon more than two years of trial in my practice, and covering many regions of head, neck, and trunk, is in the negative.

In all that we do as surgeons we are always selecting the lesser of (at least) two evils; and although—stated as a general principle—it seems desirable to keep the vasotonic centre well supplied with blood, yet there is evidence at hand that in numerous instances so brief a partial anæmia as that during an operation is well borne; and that, as compared with avoidable loss of considerable blood, in these instances the sequestration constitutes the lesser evil.

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* Dr. Crile says in this essay (*Journ. Am. Med. Assoc.*, Dec. 1, 1906): "In 61 cases I have temporarily closed the common or external carotid without immediate or remote consequences."

This leaves us in the dark as to their relative frequency. It is surprising that so serious and so safe a vessel should be classed together in this indifferent way. Even temporary closing of the common—but long enough for the extensive operation required in radical cancer work in the neck—I should consider not justifiable when the same result, namely a dry operation, can be obtained in a less questionable way.

Not long since Dr. Charles Mayo remarked that in the neck there are just two structures which he holds in implicit respect and lets alone. One of these is the parathyroid bodies—the other, the common carotids of the elderly (which is the age requiring cancer operation). Dr. John A. Wyeth in his Am. Med. Assn. Prize Essay puts the mortality from closing of the common carotid at 40 per cent. Of course, however, this does not mean temporary clamping.

But as to such clamping, or even definitive ligation, of the *external* carotid, this is a measure as wholly devoid of risk as anything surgical can well be. I say this after using it about seventy-five times, of which more than fifty are given in detail (plus excision of this vessel) in my Gross Prize Essay, which upon p. 105 discusses this question. To speak as Crile does of it, as having a mortality rate of 2 per cent. from the washing away of the thrombus of the ligated stump *causing cerebral*

Indeed, if we reflect upon the main causes of operative shock, it is demonstrable that sequestration helps to a marked degree to prevent each of these. Omitting psychic causes, also needless rough handling, and the obvious fact that it follows work in certain regions more than in others, there may be said to be four main sources of shock due to surgery. These are: (1) Bleeding; (2) length of operation; (3) excess of major anæsthesia; (4) loss of vital heat.

As to the first of these, the advantage from sequestration has to be seen to be believed. The difference between excision of the upper jaw, for instance, accomplished with this step, and the same without, would be convincing enough in itself.

(2) As to length of operation, certainly a dry field has everything to do with this.

(3) Major anæsthesia, as every surgeon knows, is an important cause both as to depth and duration; and if, as will be proven by histories adduced herewith, in a brain operation, for example, the patient once under will, at least in some cases, remain so for long periods, just from anæmia similar to that in natural sleep, we have eliminated, in every minute so devoid of drugging, just so much risk of shock.

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embolism, is simply to state an anatomical impossibility, as it does not supply the brain. Other writers have made the same curious error. I do not doubt that the occasional deaths with brain symptoms following supposed ligations of this vessel have been due to the commonest of its numerous anomalies, and the one which is the rule in dogs, namely, that there was no external carotid, or one insignificant in size, but that instead the internal, on its way to supply the brain and eye, gave off in the neck all the branches usually derived from the external carotid. (See author's Gross Prize Essay, pp. 142–143, also Chapter VII.)

I have myself cost the life of one of my earliest cases by this very blunder, with its resultant extreme anæmia of the brain. I tied, above the level of the common carotid that vessel which when controlled stops pulsation both in the facial and superficial temporal arteries; but this, the customary test, is unfortunately not at all reliable.

There are but two which are trustworthy: (1) finding a frank bifurcation of the common carotid; and (2) instant contraction of the pupil on the ligated side, where this precautionary search has been neglected, when it may not be too late to undo the damage by promptly cutting the ligature. Also, this second test can be used, doubtless safely, by intentional stoppage of circulation with the finger-tip and noting the effect, or absence of it, upon the pupil.

(4) As is well known, ether and chloroform reduce temperature markedly. Hare has shown that ether very quickly brings it down two degrees Fahrenheit below normal. Consequently, by cutting off necessity for prolonged breathing of ether we prevent this factor in shock.*

However, should any indications threatening shock appear —such as undue rapidity, weakness or irregularity of rhythm of pulse—it would be as simple as possible to end them by releasing one or both tourniquets; doing it gradually, to give the heart a little time in which to meet its added duty.

ILLUSTRATIVE CASES.

CASE I.—*Excision of Cerebellar Tumor.* This was a farmer, Mr. A. A. K., æt. 60, married, denies history of venereal. A patient of Dr. E. A. Schnell, of Round Hill, Conn. This patient seen, and subsequently operated upon, at his home in the country, Valhalla, N. Y., gave the following history: For the past six months, at least, he had complained of headache of increasing severity, located in his occiput, right side, low down. This was accompanied by an increasing inability to walk, due chiefly to dizziness. His stomach was upset, and he had frequent attacks of projectile vomiting. Also his sight was rapidly failing.

This made a picture so indicative of cerebellum tumor that I advised calling in the services of Dr. James A. Meeks, an oculist, who reported choked disc, and advised in favor of immediate operation.

This was performed on May 10, 1905, by the writer, assisted by Prof. George F. Shiels, formerly of the University of California, and by Drs. W. L. Griswold and John A. Clark, of Greenwich, Conn. Ether was the anæsthetic employed. With the trephine followed by the Devilbiss rongeur a large aperture was made exposing the right lobe of the cerebellum. An indurated portion of this was located, not encapsulated, and extending so far as the test by needle could determine, over an area of irregular contour, but perhaps involving one-third of this half of the

* Dr. R. C. Kemp's suggestion of keeping the rectum and colon filled with very hot normal salt solution during operations in general, using his rectal tube and an irrigator, deserves a more thorough trial than it has received.

hind brain. All this indurated portion was excised. It proved to be a glioma. The patient had hardly any bleeding, thanks to the accumulation of blood in his lower limbs; and, what surprised us all, once asleep he needed no more ether during all the time of operation—just three-quarters of an hour. He lay sleeping quietly, without stertor, and quite as if the natural anæmia existent during normal sleep were the determining factor in that condition rather than an artificially produced anæmia.

His recovery was without incident; and accompanied by a rapid improvement in all his symptoms. But when about a month had elapsed and he was once more up and about, in passing a catheter to relieve a prostatic congestion which troubled him occasionally, he infected himself; and the cystitis rapidly spread up the ureters, causing "surgical kidneys" and prompt death from suppression.

This outcome is recorded to give a full report; but surely the case may properly be classed as a success so far as the reason for operation is concerned; as also regarding the value of the method by cordage.

As to the advantage of avoidance, because of this, of the need for prolonged exhibition of ether or chloroform, when one reflects upon the usual risk of hæmorrhage from the delicate leptomeningeal vessels during the cerebral congestion accompanying vomiting after brain operations, and of hernia cerebri from bursting of the sutures in the dura, from the same cause, prevention of these risks seems indeed a distinct gain.

Regarding the duration of this operation without fresh anæsthesia and yet without pain or returning reflexes, for three-quarters of an hour of operation, we recognize of course that work upon any portion of the encephalon, once the dura is penetrated, is painless, except in the tract of any of the sensory cranial nerves, or along the course of the fillet. Perhaps brain work in a sensitive region would have compelled resumption of the anæsthetic sooner. But the longest period during which Sir Victor Horsley, for example, has been able to operate upon a cerebellar growth without necessity for renewal administration of the anæsthetic has been twelve to fifteen minutes

(loc. cit.). In the final case recorded in this paper the same complete success as to anæsthesia will be found noted. It has also been observed in other than head operations.

Though this was by no means an early instance of my employment of sequestration, it was the first in brain-work, and the earliest in which it occurred to me to try whether the moderate brain-anæmia might not suffice to maintain operative analgesia—once the patient was fully narcotized as usual.

CASE II (Operations 2 and 3).—*Trephining for Extradural Hæmorrhage.* Mr. F. S., American, æt. 30; telegrapher, single, denies venereal history. First seen by the writer November 21, 1905, in his service at the City Hospital, twelve days after receiving a single severe blow upon the right side of the head from a club. No clear history obtainable as to his condition during the interval between the injury and admission—except that he complained of much headache and seemed increasingly stupid. Those about him were very unobservant people. When attention was first drawn to him he had a temperature of 102° F., rectal, and he was suffering from severe clonic convulsions, chiefly of his entire left side; to a lesser degree also upon his right half. He was wholly unconscious, and had gradually become unable to be aroused, during the past three days of the twelve. Both eyes were directed sharply toward his right; pupils equal and of normal size. Had a moderate degree of Cheyne-Stokes respiration. The shaven skull presented evidence of but one wound, quite superficial and partly healed. This was about 5 cm. in length and situate over the middle of the right Rolandic fissure.

Evidently this man was suffering from pressure upon his brain; and the temperature of 102 led me to the erroneous diagnosis that we should find as cause, between dura and skull, the products of inflammation—fibrin, serum and pus. Instead, nothing was there but a large clot from rupture of the middle meningeal. And slowly the bleeding had increased the pressure until the convulsions, etc., appeared.

In a recent article upon brain surgery Dr. M. Allen Starr* in discussing extra dural hæmorrhage asserts without qualification

* Jour. Am. Med. Assn., Sept. 22, 1906.

that the symptoms develop within six hours after the injury. Here is a case infinitely slower; and I have operated upon several where a few days had elapsed. It is plain that the time is dependent chiefly upon (*a*) the size of the broken arteriole and (*b*) upon what region of dura is being stripped up. In the temporal fossa this membrane is least firmly attached to the bone. Starr, in the same article, considers that when the hemiplegia, for instance, "does not come to its height for three or four days it is probable that there is a *surface hæmorrhage* due to the injury of a vein of the pia mater. A lumbar puncture will reveal bloody cerebro-spinal fluid." As stated, I am convinced that hemiplegia so developing in point of time would more often be explained as just mentioned. However, certainly lumbar puncture would be of unquestionable value simply in confirming a diagnosis of hæmorrhage; although the indication to enter the skull promptly for relief of pressure would exist equally in either case.*

Regarding the question at which probable level beneath the skull a surgical hæmorrhage has occurred, perhaps it may be of interest to note how wide a difference of opinion is found even among surgeons of wide experience. From without inward:

(I) Deaver asserts † that all cases seen by him have been subcranial—(*i.e.*, between dura and skull); and he adds that so easily is the dura of the temporal fossa separated from its bone that, given a ruptured branch of the middle meningeal, this will happen without any fracture whatever.

(II) *Subdural* (*i.e.*, between dura and arachnoid). According to the English surgeon, Prescott Hewitt, this is the commonest variety.

(III) *Subarachnoid* (and into the meshes of the pia mater). Erichsen states that the commonest variety is at this level. (I do not imagine that it is possible to differentiate, practically, (II) from (III), and probably Hewitt and Erichsen mean one and the same thing.)

(IV) Into the substance of the brain or its ventricles; *i.e.*, true apoplexy. Unquestionably the rarest of these four, as a result of traumatism.

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* Blood-tinged cerebro-spinal fluid withdrawn by lumbar puncture is a valuable sign of fracture at the base of the skull.

† Phila. Med. News, Feb. 15, 1890.

Returning to our patient. Operation, under ether, assisted by the House Staff, November 21, within an hour after the case was reported to me. Cordage for sequestration. Incision upon his right. Upon exposure of the bone, an undepressed fracture was at once evident, beginning slightly lower than the level of the skin abrasion, and extending roughly along the Rolandic line, and thence steadily downward and forward across the base of the skull further than could be followed. On removal of bone with the Devilbiss rongeur, a very extensive and thick bloodclot was exposed—plainly the source of the left hemiplegic convulsions. Its upper part was quite firm and partly organized, more so than that lying at the base, and which latter was evidently more recent. Irrigation alone was ineffective; nothing short of the blunt curette sufficed to break up and dislodge the clot. Much bone had to be sacrificed to get room to do this work; and for this the temporal muscle was split clear down to the zygoma and its edges widely retracted. The handle of the curette was bent nearly to a semicircle, to permit scraping away the thick clot which was continuous right across the base, and even then its limits could not be reached. From some point at the very base blood welled up at the seat of fracture, as soon as the clot was dislodged there. This was controlled by packing down against this point a thin strip of damp gauze well rubbed with glutol (formalin gelatin, powdered). This was removed five days later without starting up the bleeding (two attempts, one upon the third, one the fourth day had showed that we must still wait).

There was no recurrence of the left-sided convulsions; the temperature promptly fell to normal and remained so; and the patient became partly conscious, with eyes no longer turned toward his right.

However, forty-eight hours after the first operation, my house-surgeon, Dr. Thomas, reported by telephone that the man had begun to have severe clonic convulsions of his entire *right* side (it will be remembered that he had at first right-sided convulsions, but to a far less degree than upon his left), and a resumption of Cheyne-Stokes breathing. Within an hour thereafter I visited him, finding the seizure apparently nearly as bad as that upon the opposite side had been. This was to me most puzzling; however, the indication as to my duty was a plain one.

Accordingly, the patient being again anæsthetized, the left Rolandic area of the skull was this time exposed and penetrated; but although considerable bone was removed with the Devilbiss rongeur, no blood clot was found; nor did the flat end of a probe passed between bone and dura at various points reveal any. Nevertheless the dura bulged into the bony gap, and without its normal pulsation. (I subsequently noted, in other cases, that the accumulation of blood in the limbs regularly puts a stop, almost or wholly, to the customary brain-pulsation observed, otherwise, in normal cases at operation.) Upon turning up a flap of dura we now exposed, lying beneath it—between it and the arachnoid and pia—an extensive, thick, partly organized clot, firmly adherent, covering an area as large as the parietal bone, and to all appearances being as old as the one removed from about the same level upon the opposite side two days earlier. It was removed in the same way—by blunt curette and irrigation. Plainly this clot was the main cause of his right hemiplegic convulsions. But no discoverable fracture—not even a crack—existed upon this left side. It must be clearly remembered, in studying this most rare case, that whereas the clot was *external* to the dura upon his right, it was *internal* to the dura upon his left. Unless this is explicable as an example of that condition, "contrecoup," far more often written about than seen, the writer is unable to understand it. It seems probable that the extradural, basal bleeding re-started up at the first operation, as already chronicled, went on slowly beyond the point reached by the packing (which could only be extended to his left a little beyond the median line at the base); and spreading from below upwards, on his left, after the two days became—*plus* the large *subdural* clot—enough of a pressure-factor to have re-excited the right side convulsions, etc.

The recovery was ideal, and without incident. Three weeks later this patient was shown at a meeting of the Polyclinic Medical Society. At that time his faculties were entirely restored.

Regarding the bearing of these two operations on the special topic of this paper, all the staff noted with interest that, once under the anæsthetic, the patient slept quietly during the work upon both skull and clots, and only once or twice was a few drops more required. The first operation lasted fully an

hour; the second, about forty minutes. Also, it would seem probable that the accumulation of blood in the limbs aided clotting in contact with the gelatin-gauze, because of diminished blood-pressure at the bleeding point.

One deceptive sign in this patient—the temperature of 102° upon the twelfth day after the injury—is of interest. After barring out a rise of thermometer from infection of the superficial wound, should such be present—or from malaria, bronchitis, gastric catarrh, and from constipation—in a word, the usual causes, here remains a case requiring the opinion of an expert; and one of the neurologists to the hospital, Dr. Græme M. Hammond, expressed the opinion that the fever was due to pressure-irritation of the thermotaxic centre.*

A case of this kind is distinctly encouraging as showing once more that a class of accidents—hæmorrhage from fracture at the base, until recently not held operable—can sometimes be saved by active intervention.

Case III.—*Trephining for Cerebral Cicatrix with Dural Adhesions.* This patient is a young gentleman, F. B. R., Jr., æt. 18, who has been afflicted since the age of seven, at which time he fell from a height, fracturing the right side of his skull. Operation was required, and performed by a certain New York surgeon. During all the years between seven and eighteen this boy has been subject at times to the most violent fits of temper, though ordinarily of a most gentle and tractable disposition. Latterly he has taken to drinking heavily, and has developed a periodic dipsomania. Upon examination of the skull two wide scars, each of about a finger's length, crescentric in shape, and

* Dr. Willy Meyer, in the discussion following the reading of this paper, reported a case of his own during the past year, exactly parallel as to fever, and hence as to reason for supposing the hemiplegia to be due to pressure from products of inflammation—fibrin, serum and pus. But operation proved that the febrile temperature was caused only by a large blood clot beneath the skull. At a recent meeting of the N. Y. C. Surgical Society Dr. Meyer has recorded yet another instance of such deceptive rise—the case proving at operation to be aseptic. However, absorption of fibrin-ferment from the clot, or other quite usual causes of such rise would seem to explain it without need of the assumption given in the text.

roughly parallel with each other, indicate the fields of operation consequent upon the fracture in his childhood. The parietal boss was about midway between these scars. Under each of these broad cicatrices it was believed that the meninges were adherent to the brain, as a consequence of the original infective inflammation: for there was a history of prolonged suppuration before these semicircular wounds healed. For the past two to three years there has been frequent twitching of the fingers on the left—the side opposite these scars. His mother says there is never an hour when they are quiet, except when they are controlled by his will. This indicates cortical irritation in the region of the hand-centre in the præcentral convolution. Operation was advised, to separate brain from an adherent dura mater, if nothing else should prove necessary. Consultation with Dr. Frederick Peterson resulted in receiving from him urgent advice to permit operation; not as definitely promising improvement, but as positively asserting a hopeless condition if operation should be refused. In other words, the knife was considered the lad's only chance, and a rather poor one at that.

Operation was performed by the writer in Dr. Bull's private hospital, December 6, 1905, assisted by Drs. John B. Walker, George F. Shiels, J. H. Waterman, A. L. Goldwater. Anæsthesia (ether) by Dr. Thomas Bennett. An incision was made to run midway between the two long and wide crescentic scars aforesaid and the skull was penetrated accordingly. With the Devilbiss rongeur an area of the dura as wide as the thumb was laid bare, and all these pieces were saved in warm, normal salt-solution. Just as anticipated, adhesions were found. In stripping these away from the brain the sound of the separation could be heard to the confines of the rather large room—an indication of their degree of firmness. It was at one time contemplated to prevent readhesions by leaving goldfoil or other smooth foreign material in place between brain and dura; but final reflection caused me to fear that even this might (upon this hypersensitive cortex) itself constitute, as a foreign body however smooth, a brain irritant. Instead, a thin layer of blood was allowed to form over this brain area and to clot firmly, before permitting the brain to come into relationship again with its dura. This was only possible by aid of the sequestration of blood in the limbs. Because of this the brain was found by no means fully filling its brain-case;

the stripping was accomplished with a dull tool curved to follow the brain contour; and one could see to work within the curve of the calvarium far beyond what would have been possible, and with far less risk of brain-laceration, than if a similar tool had been passed, guided only by sense of feel, between a congested, full brain and its skull.

The brain-work being ended, it was thought best to replace the pieces of skull. Since they were so small and of exactly equal size, each compared with all the others, nothing can be more ideal than the Devilbiss rongeur for encouraging such bone-replantation. Between thirty and thirty-five pieces were fitted together upon the dura, when this had first been sutured, where divided, with size double o of chromicized catgut. All of these pieces lived, being nourished by capillarity. It is obvious that the smaller the pieces of tissue of whatever sort which we attempt to engraft—whether of bone or ovary or thyroid gland or whatnot—the better its chance of surviving. For, its blood vessels being clotted, nothing but capillarity can carry to its interior the vitalized plasma which alone must nourish it.

In this instance we forgot to test the point noted in previous skull cases—whether anæsthesia once accomplished might not have been maintained by the brain anæmia due to the cordage. However, Dr. Bennett was asked to watch for any adverse signs consequent upon the accumulation of blood in both thighs and legs, and he reported that neither pulse nor respiration was affected in the least adversely. Duration of operation, one hour.

The patient had an ideal primary healing, his scar being practically invisible. As to results, from the time he awoke again until to-day he has had no return of the twitchings of his hand, and he volunteered the statement that his head feels better and clearer than for years. However, after a few weeks he went upon a violent spree; and after trying hypnotic suggestion with only temporary benefit, and the Oppenheimer "cure" with none at all, he has now been sent upon a sea voyage to South Africa in a sailing vessel with a temperance shipper and with no liquor aboard. It is, I fear, easy to prophesy the ending of this most pitiful case—an only son of fine parents. Perhaps, had the operation in question been performed sooner, before the dipsomania showed itself, removal of the adhesions as a persistent cause of brain irritability might have effected a real cure.

CASE IV.—*Trephining for Cerebral Cicatrix with Dural Adhesions.* Miss O'C., a patient of Dr. J. D. Quackenbos, æt. 27, is brought with the following history. Since the age of eleven she has been an epileptic. In that year while swinging in a "scup" she fell, striking her head with enough violence against the corner of a house to render her unconscious. Her attacks at first, though irregular in interval, as always, were a month or less apart. For the past year they have much increased in frequency, latterly the worst being at night, and averaging perhaps a fit in each 24 hours. Her mental powers, always rather poor since the accident, have noticeably deteriorated of late. The attacks begin by a feeling of dizziness; if there is a true aura of any kind the patient is unable to describe it. She drops unconscious, kicking and making swimming motions with her upper limbs. Both sides are alike as to their involvement in the attacks. Menses regular and not painful.

An examination of the shaven scalp revealed an old cicatrix about 4 cm. long, over a depression of the skull, of nearly that extent, and of about 1 cm. depth, situate about 2 cm. above and to her left of the inion. This is where she was struck, as a child. Although this case is of a type of epilepsy offering little hope indeed from operation, when compared with the results of surgical intervention where the type is Jacksonian, yet it seemed quite likely that there was irritation from the depressed bone beneath the scar; and in any case, operation was urged by Dr. Quackenbos as being her only chance of help. Accordingly this was done at the Polyclinic Hospital, before the class, upon April 10, 1906. By use of the DeVilbiss trephine and rongeur all the bone involved was removed. Although there had been some depression of the inner table, this was less than of the outer, the diploe having been crushed compact at this point; and there was no evidence of irritation beneath the bone, no thickening nor exceptional adhesion of the dura, nor (tested by the flat end of a probe through a tiny slit in the dura) was there any brain adhesion beneath. Obviously, little improvement could be hoped for in consequence of our work. Because of the depression the pieces of bone were not replaced; and to protect the dura over the rather large bony gap, it was decided to use the special kind of celluloid plate recommended by the writer at the St. Paul meeting of the American Medical Association a few years ago; a

kind carefully deprived of all free nitric acid, and with a trifle of synthetic urea replacing the usual irritant and abundant camphor, to give resiliency. Such a plate, transparent, resembling a yellow window pane, has several advantages, into which I cannot go here. In this instance, fifteen minutes was the longest period during which the cording enabled the anæsthetist to discontinue chloroform. Once more it was noticed how satisfactorily dry was the operative field.

This patient's recovery was per primam. At this time, some seven months after operation, her mother reports that the attacks are somewhat milder and less numerous than before operation. However, such temporary improvement, due apparently to the vigorous counter-irritation as much as anything, often results from mere penetration of the skull.

Case V.—*Excision of Foot-Centre in Cortex for Relief of Jacksonian Epilepsy.* Mr. C. R., is a patient of Prof. Græme M. Hammond, in the City Hospital, New York, who refers him to me for operation. Age, 48; American; unmarried; occupation, driver; is a blond, fairly nourished but anæmic. Denies trauma, also venereal disease. Has had for seven years attacks of left-sided convulsions, at very irregular intervals of about two to three months, latterly rather more frequently, and coming on sometimes at night, which was not at first the case. Has long complained of headache over the right Rolandic area; no known cause for this. His attacks begin without aura, other than a severe dull headache for a half hour before an attack, the pain being in the right Rolandic region. Then comes twitching of the left great toe, spreading rapidly to foot, leg and thigh, to left side of body, arm, and finally to face; but he never loses consciousness. Great weakness of the muscles involved for some days afterwards.

Two years ago was operated upon by another surgeon, the scar being plainly visible. A large omega-shaped flap was then made and the skull opened accordingly. This was fully 6 cm. too far forward to expose the motor centre, and no good whatever was accomplished.

Upon December 17, 1906, I operated, in the presence of Profs. Hammond and George F. Shiels and Dr. Edwin Beer, and assisted by Dr. Wrenn, house surgeon, and the rest of the resident staff of the City Hospital. Dr. Dettweller, anæsthetist.

Dr. Shiels kindly took charge of the sequestration-work. This patient had a severe degree of mitral insufficiency, not well compensated by hypertrophy. Chloroform was tried at first. Being badly tolerated, ether was substituted. Operation about two hours long, due chiefly to annoying oozing from the cut edges of the dura, which proved three to five times thicker than normal, over the area exposed (right Rolandic). This bleeding was trivial in amount, but of course had to be wholly controlled before closing the wound; also, the dural upper surface had to be dried before, with a naked copper wire and weak Faradaic current, the foot centre could be located. This being indicated approximately, the dural flap was cut accordingly; firm adhesions were found, binding the brain and leptomeninges to the thickened dura, and were separated with some little difficulty. Next, the precise situation of the foot-centre was ascertained upon the naked brain, and excised, cutting out the entire thickness of gray cortex over a superficial area of about 1½ cm. square. This centre was found, as expected, to extend beyond the top and to include the adjacent mesial part of the lobule. Just as a matter of interest the arm and hand centres were also located by the electric current, lying entirely anterior to the fissure, and between the centres governing the face and the trunk-muscles. To prevent re-adhesion a thin sheet of gutta-percha tissue was laid smoothly in place over the brain, covering the whole area exposed, and then the dura mater was sutured.* To allow relief from pressure upon the cortex by the thick dura, the skull was not replaced, but instead a slightly dome-shaped piece of the special celluloid mentioned in Case IV was inserted. This was of but half the entire thickness of the calvarium in this region, yet was very strong, rigid and smooth. It rested upon a narrow ledge of the vitreous table, the outer one having been chiselled away a trifle for this purpose.

Regarding the result of sequestration in this case, it was very unsatisfactory because of the man's heart disease. For several periods, of about seven minutes each, anæsthesia was withheld, but then had to be resumed. Probably without sequestration the same could have been done. As soon as the limbs became

* Prof. Hammond has seen the skull re-opened five years after such a gutta-percha tissue layer had been used, and states that it was found very full of holes; and evidently before much longer would have quite disappeared by absorption.

distinctly swollen the heart-beats mounted quickly to 130 or so, at which point, upon uncording, they dropped speedily to about 80. This was tried a second time, for purposes of study. Of course this operation was no fair test of sequestration; and this, too, was the reason of the long delay in checking the oozing from the dura. Were the blood not so actively flowing, the steaming gauze would have sealed the vessel-mouths promptly. Given an example of uncompensated valvular disease, we plainly have one of the instances—to be discussed later—where this operative aid (sequestration) is counterindicated.

Healing was by primary union throughout, in this patient's case, and without incident. As to the results of the foot-centre excision upon his epilepsy, Prof. Hammond's detailed report is not given herewith because it has no bearing upon surgical technique; but he expresses himself as well satisfied, and hopeful of a cure, so far as the interval of time since operation permits him to judge.

Case VI (and last, making seven head-operations by the method under discussion).—*Excision of Hand-Centre in Cortex for Relief of Jacksonian Epilepsy.* Mr. D. E., is a patient of Prof. Græme M. Hammond, in the City Hospital, New York, who refers him to me for operation. Age, 20; American; no occupation; single; denies venereal. He is short, dark, well-nourished, stupid in expression. At the age of four met with an accident, falling a short distance (unknown), striking upon his head. Doubtful whether this is important, for the convulsions began only at the age of nine. No other ascertainable cause. These occur from once to several times daily. They begin without aura, by twitching of the flexors of the left hand, spreading quickly up that arm and into the same side of the face. He is never unconscious because of them, but feels exhausted afterwards. His left hand and arm are distinctly smaller and weaker than his right; the hand-clasp about half that of the right. The left hand is always the colder also. He can use simple language coherently, but voluntarily mentions a failing memory; always poor but much worse of late. Is anxious for the operation advised by Prof. Hammond—though that gentleman has but slight hope of its effectiveness in this case.

Operation in the City Hospital December 31, 1906. Present: Prof. Hammond, and resident staff; Dr. Wrenn, house surgeon;

Dr. Dettweller, anæsthetist. Chloroform anæsthesia, under which the operation was begun; but it was discontinued, and thereafter (forty-five minutes) work continued, including exposure and cutting of dura, and its final suturing, with only the analgesia due to the sequestration, and without any restlessness or other indication of suffering.

The Rolandic area upon his right was marked out, an omega-shaped flap, including the bone, was lifted by aid of the Devilbiss rongeur, and attempts made to locate the hand-centre through the dura by the copper wire and very weak Faradaic current. So irritable was the entire motor area of his cortex, however, that wherever touched with the wire all the muscles of the opposite side responded. However, after some minutes of this testing, and doubtless excited by it, a convulsion occurred, lasting a few minutes, and exhausting thereby the excessive irritability; so that upon its cessation we were able without difficulty to locate the hand-centre, causing no twitching in muscles elsewhere. The dura being turned up, the centre was more accurately marked, and excised, taking out a square piece of the gray, down into the white, the entire transverse width of the præcentral lobule; in dimensions about as in the previous case.

Nothing abnormal was noted at operation either in appearance of bone, dura, leptomeninges, or brain, in this patient. However, by microscope, the pathologist reports evidences, in the piece of cortex excised, of chronic abnormality in cellular arrangement. Details omitted as having no bearing upon surgery.

There remains one point of exceptional interest. During the cutting of the skull by the Devilbiss rongeur, along the terminal 4 cm. of this omega curve, the blade, which, travelling beneath the skull, should never penetrate the dura—and never has before, to my knowledge—in some way slipped through, and for this distance ploughed the brain-cortex. This caused bleeding, welling up from the cerebrum at points not possible of exact location. I did not wish to pack, neither to apply chemicals—other than adrenalin solution upon a narrow gauze strip tucked gently down into the brain tear—which, however, did not stop the flow at all. Finally, remembering that boiling water had not harmed the pneumogastric nerve in the case operated upon at Dr. Wyeth's clinic (see footnote earlier in this paper), I tried gauze wrung out of water at 212° F. and tucked down into the tear, as before.

This succeeded after several repetitions of a few seconds each. It apparently did no harm to the brain tissue, so far as the recovery is a guide. A narrow strip of gutta percha tissue, to prevent adhesion of the brain to the dura at this point, was smoothly laid down, and the dura was sutured above it. The bone-flap was replaced. After the dura was sewn the cording was released, taking five minutes; and now, after three-quarters of an hour without chloroform and without pain, the patient began to wake up. Healing was by primary adhesion, with no unpleasant features whatever.

This case is too recent to permit of decision as to whether the operation is going to be of permanent benefit to his epilepsy or not.

If we now discuss the counterindications to this, which for convenience has been called sequestration surgery, it will at once be seen that they are quite numerous, and that a reasonable degree of common sense must be employed in determining when to use and when to avoid it. Like every weapon in our armamentarium capable of good, it is also capable of harm, if turned against a patient by a surgeon gifted in that way. Let us study these points, concerning which I have much to thank my friend Dr. Boise, of Grand Rapids. His article upon "Post Operative Embolism" is an equally clear study of anteoperative thrombosis; or again, of the causes which during sequestration would operate to produce clotting of the comparatively quiescent blood. To study these in an orderly way, one may say that there are three: (*a*) changes in the blood, (*b*) changes in the vessel walls, and (*c*) changes in speed of current. The last would be unimportant without one or both of the first two named; for normal blood will not at all readily coagulate when held even without motion within normal blood-vessels, and in our technique a moderate degree of circulation is maintained throughout. In Bier's method of treating joint inflammation often the partial stasis by cording is kept up for a half day at a time, and, though hundreds of cases have been reported, so far without dangerous result. But given either unhealthy blood or blood vessels as a predisposing cause,

slowing the current would then act as an exciting one, and make sequestration dangerous from venous thrombosis and possibly subsequent pulmonary embolism.

To specify several blood-conditions of serious import, we name the following: Recent typhoid, or any other septic condition of the blood, such as puerperal sepsis not long past; chlorosis, and indeed severe anæmia of any sort; and the presence of lime-salts in excess. Haward* shows that the blood of typhoid convalescents is much more coagulable than normal, and that it contains twice as much lime salts; and implies that its increased coagulability is due to this last fact. Obviously, since increase of these salts invites clotting, and indeed since we use this knowledge in preparing patients for certain operations where there is likely to be troublesome bleeding, we must recollect not to do so if intending to employ sequestration.

As to diseases of the vessel walls, atheroma is an obvious counterindication. Of course yet others exist which we cannot stop to study at this time.

As tending to prevent thrombosis, it is interesting and soothing to remember that prolonged smoking markedly has this good effect. B. M. Richardson showed by experiment that after a long day's smoking the blood refused to coagulate at all, where in the same patient, blood drawn in the morning had clotted in two minutes.†

Accepting Horsley's assertion, quoted earlier in this paper, it follows that the duskiness of the limb—the cyanotic or venous character of the blood held within it—would rather tend to prevent clotting; at least he strongly recommends arterializing the blood by oxygen, when very dark in color, as a means of causing coagulation when bleeding would otherwise continue. And yet Haward (loc. cit.) names carbonic dioxide among a list tending to *increase* coagulability of the blood, and oxygen as *decreasing* the tendency to clotting.

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* Hunterian lecture, Lancet, March 10 and 17, 1906.

† The Cause of Coagulation of the Blood, p. 101 (quoted by Haward, *loc cit.*).

Plainly there is a contradiction here; and either Haward or Horsley is incorrect in his deductions.

In conclusion, the following are the chief advantages of the method by sequestration in brain work of certain kinds:

(1) A diminution in amount of anæsthetic needed, with consequent relative safeguard against bleeding due to straining from subsequent vomiting, and against hernia cerebri; also against lowering of vital heat.

This operative analgesia is only obtainable with limbs well swollen and dusky. It is not always accomplished; but assuredly is in certain patients, the number studied as yet not being large enough for us to reach percentage conclusions.

(2) Ease of control of hæmorrhage during operation because of lessened intravascular tension.

(3) A shortened operation because of a dryer field.

(4) Through lowered intracranial pressure consequent upon accumulation of blood elsewhere, there is lessened danger of sudden death from pressure upon the respiratory centre during work upon brain-tumor, or upon depressed fractures, etc.; and, too, just in proportion as there is bleeding, whether external or into the limbs, there is increased depth and frequency of breathing.

(5) More space between brain and brain-case, enabling the operator to work between, in removing old clots requiring curettage, or the separation of adhesions, etc., without risk of laceration of the brain surface.

PAPILLARY-CYSTADENOMATA OF THE BREAST.

A REPORT ON TWENTY CASES OF THE PAPILLARY CYSTADENOMA TYPE OF FIBRO-EPITHELIAL TUMORS OF THE BREAST.*

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In the Oration in Surgery delivered by Dr. J. Collins Warren at the meeting of the American Medical Association at Portland, Oregon, in July, 1905, a classification of benign breast tumors was presented which was based upon the study of 758 consecutive cases collected and analyzed by the writers of this communication. This classification was offered in the hope that the existing confusion in the nomenclature of tumors of the breast might be done away with.

The difficult point in the classification of benign breast tumors is the association of connective tissue and epithelium in their composition. The breast is a gland structure of epithelial lined ducts supported in a stroma of connective tissue. All tumors having origin in the breast tissue show a participation of both of these elements in varying proportion. In one case perhaps the fibrous tissue predominates, in another the epithelial, but an authentic case of a tumor composed solely of either fibrous tissue or epithelium has not yet been described. It is because of the attempts of different pathologists and clinicians to apply to the tumors of the breast the names accepted for tumors of other organs that such hopeless con-

* Read at a meeting of "The Obstetrical Society of Boston," Nov. 27, 1906.

fusion has resulted, and it was not until Ribbert in his classification of tumors offered a special group of mixed or "fibro-epithelial" tumors that this confusion began to pass away. Ribbert's classification, however, is purely pathological and does not lend itself to the description of the different forms of tumors of the breast as they appear in surgical practice, and the purpose of Dr. Warren's classification is to harmonize the clinical signs and symptoms of these tumors with their pathological nomenclature.

The first, and perhaps most important, distinction made by Dr. Warren's classification is the separation from the group of tumors of the diffuse processes, giving to the latter the names of (*a*) diffuse hypertrophy and (*b*) abnormal involution. Cases of diffuse hypertrophy have sometimes been confounded with tumors of the periductal fibroma type, and abnormal involution, or cystic disease, has been regarded by many writers as a peculiar form of a new growth, and has been called cystadenoma. Because of its diffuse character, however, this disease cannot properly be regarded as a tumor, although the epithelium shows a tendency to proliferation which in certain respects closely resembles a neoplastic process. The lack of encapsulation, however, and the participation in the process of the whole breast and often of the breast of the other side, seems to warrant its removal from the category of true new growths.

The fibro-epithelial tumors of Ribbert have been divided by Dr. Warren into two groups—the fibrous and the epithelial types (see Table I).

TABLE I.

CLASSIFICATION OF BENIGN BREAST TUMORS. (WARREN.)

I. Fibro-epithelial tumors:
   - (A) Fibrous type
     1. Periductal fibroma.
     2. Periductal myxoma.
     3. Periductal sarcoma.
   - (B) Epithelial type (Cystadenoma)
     1. Fibro-cystadenoma.
     2. Papillary cystadenoma.

II. Hyperplasia:
   - (A) Diffuse hypertrophy.
   - (B) Abnormal involution (cystic disease).

Tumors of the fibrous type in which the fibrous tissue predominates have been called periductal fibroma, periductal myxoma, or periductal sarcoma. They are tumors arising from the peculiar hyaline periductal fibrous tissue of the breast, and they are made up for the most part of this fibrous tissue, although they contain portions of the epithelial gland substance in the form of much distorted ducts and clefts lined with epithelium. The bulk of the tumor is made up of fibrous tissue and it is classified as periductal fibroma, periductal myxoma, or periductal sarcoma, according to the degree of cellular development and richness in nuclei of this tissue. In these tumors it is obvious that the epithelium participates in the growth only as it is secondarily involved by the increase in amount of the fibrous tissue. They are the firmly encapsulated tumors found in the breasts of young women, may be single or multiple, are freely movable in the breast substance and have passed under a variety of names, such as, fibro-adenoma, chronic mammary tumor, proliferous cyst, adenocele, cystosarcoma phylloides, intracanalicular papillary fibroma, etc.

The epithelial type of fibro-epithelial tumors are those in which the epithelial new growth overshadows the growth of fibrous tissue. In these tumors fibrous tissue is present merely as a stroma to support the epithelial new formation. Tumors of this type, or cystadenomata, are divided into two main classes—fibro-cystadenoma and papillary cystadenoma. The first class, the fibro-cystadenomata, are localized tumors of periductal fibroma origin, in which epithelial proliferation or cyst formation has progressed to such an extent as to overshadow the growth of fibrous tissue. These tumors have been described in the past as cystic fibroma or cystic fibro-adenoma. They are comparatively rare and are of little importance as compared to those of the second group.

Papillary cystadenomata are not uncommon. They are localized tumors—either single or multiple—and involve, as a rule, the large ducts of the breast. They consist of one or more cysts partially filled with papillary outgrowths, arising from

the wall. The papillary growths have a vascular branching connective tissue stalk supporting a luxuriant growth of epithelium in the form of villous projections and gland-like interlacing tubules and canals. The epithelium shows no tendency to infiltrate the surrounding tissues. Tumors of this class have been recognized and described by many writers and under many names: adenoma, villous papilloma, duct papilloma, duct cancer, cystadenoma intracanaliculare, carcinoma villeux, endocanilicular papillary fibroma, etc.

The material upon which this report is based consists of twenty cases of papillary cystadenoma. The specimens were obtained from private practice and at the Massachusetts General Hospital in the services of the following surgeons: Dr. J. C. Warren, Dr. A. T. Cabot, Dr. H. H. A. Beach, Dr. C. B. Porter, Dr. M. H. Richardson, Dr. J. W. Elliot, Dr. W. M. Conant, Dr. S. J. Mixter, Dr. F. G. Balch, Dr. R. B. Greenough, Dr. C. A. Porter, and Dr. C. L. Scudder, to all of whom the writers would here express their thanks for the privilege of reporting the cases. Much of the pathological material was placed at our disposal by Drs. W. F. Whitney and J. H. Wright, to whom we would also express our gratitude.

Of the twenty cases of papillary cystadenoma three showed the presence of adenocarcinoma. In the other seventeen cases no evidence of malignant disease was to be obtained. A gross and microscopic examination was made of the specimen in nineteen of the twenty cases; in seventeen cases the microscopic specimens and in many cases the gross specimens also were available for re-examination.

The gross appearances of the seventeen specimens of simple papillary cystadenoma showed the following characteristics: A palpable tumor was present in the breast substance in every case. In twelve instances the tumor was single. In five a number of different nodules were present, forming a conglomerate mass. The tumors varied from the size of a pea to that of an orange. Their situation was almost invariably in the central portion of the breast close to or under the nipple, although the larger cysts extended outward and occasionally

occupied almost the entire substance of the gland. In cross section these tumors presented one or more cysts of varying size containing fluid, which was usually bloody, and filled to a greater or less extent by papillary outgrowths from the wall. The cysts were as a rule well marked off from the surrounding breast tissue and were not adherent to the skin, although in six cases the skin appeared to be closely applied over the tumor and was not freely movable, a fact which was attributable rather to the size of the cyst and its position near the nipple than to any infiltration of the tissue. Retraction of the nipple was noted in the record in three of the seventeen cases of simple papillary tumor and in two of the three cases of adenocarcinoma. It is possible that the development of a benign tumor in the large ducts acts in somewhat the same way as the development of cancer to cause a drag upon the ducts and retraction of the nipple.

The axillary glands were enlarged in only two cases. They did not show malignant involvement even in the cases of carcinoma.

Microscopic sections of the tumors showed one or more cysts. The cysts were as a rule well marked off by a definite layer of fibrous tissue from the surrounding substance of the breast. The breast tissue usually showed evidence of compression by an increase of its fibrous tissue, and occasionally the presence of a small amount of round-cell infiltration. In some cases involution changes were present in the surrounding tissue, which is not surprising when we consider the age of the patients under consideration.

The walls of the cysts were lined with flattened or columnar epithelium which was apparently derived from the larger ducts (Figs. 1 to 6). In one specimen of a tumor of this nature, not in this series, a fortunate section revealed a continuous line of epithelium from the nipple to the wall of the cyst cavity.

The most characteristic feature was the presence of papillary outgrowths from the cyst wall. These papillary growths were composed of a fibrous tissue stroma, with many blood vessels, supporting one or more layers of epithelium continuous

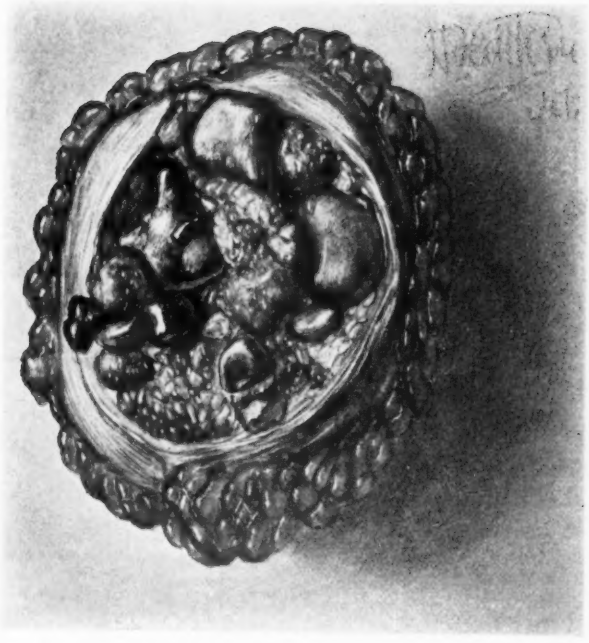

FIG. 1.—Papillary cystadenoma from a girl of 10, removed by an areolar incision. The specimen consisted of a cyst cavity situated directly under the nipple and filled with papillary ingrowths. These varied greatly in size, shape, consistency and color, and the whole could be aptly compared to a gall-bladder full of stones. The color and shape of these ingrowths was due to œdema, hæmorrhage and necrosis.

FIG. 2.—Papillary cystadenoma. The cyst was of four years' duration and occurred in a woman 43 years old. It illustrates well the single large type of cyst, the size being due not to the rapid growth but to the long duration. There was a small fistulous opening through the skin. The cyst contained a papillary mass of grayish white friable tissue, which on section was composed of distorted glands and fine fibrous stalks largely necrotic.

FIG. 3.—Papillary cystadenoma. Section showing the cyst wall and papillary ingrowth. The cyst was lined by a layer of flattened epithelium. The fibrous tissue around this was dense and infiltrated with round cells. The gland ducts in the vicinity were flattened and mechanically disturbed, but otherwise showed little change. The papillary growth completely filled the cyst, which was 2 cm. in diameter. It apparently had several attachments, one of which is seen to the left of the photograph, although this evidently is not the chief one. The appearance of the glands and fibrous tissue is well shown. The dark areas in the papillary growth, (suggesting artifacts) are vessels filled with blood. On the right of the drawing (where the glands are not as numerous) the fibrous tissue is œdematous.

FIG. 4.—Papillary cystadenoma. Small multiple type. These tumors were situated under the nipple and occupied the larger ducts. They were all small, the largest being but ½ cm. in diameter. The papillary projections in the one to the right of the photograph are formed of delicate branching stalks of fibrous tissue covered with epithelium, the whole forming an irregular mass of somewhat atypical gland ducts. In the cyst in the center of the specimen the epithelial proliferation has been so great as to mask the fibrous tissue, while in that in the left, the fibrous tissue is abundant, somewhat necrotic and œdematous. There is a large amount of interstitial fibrous tissue surrounding the cysts.

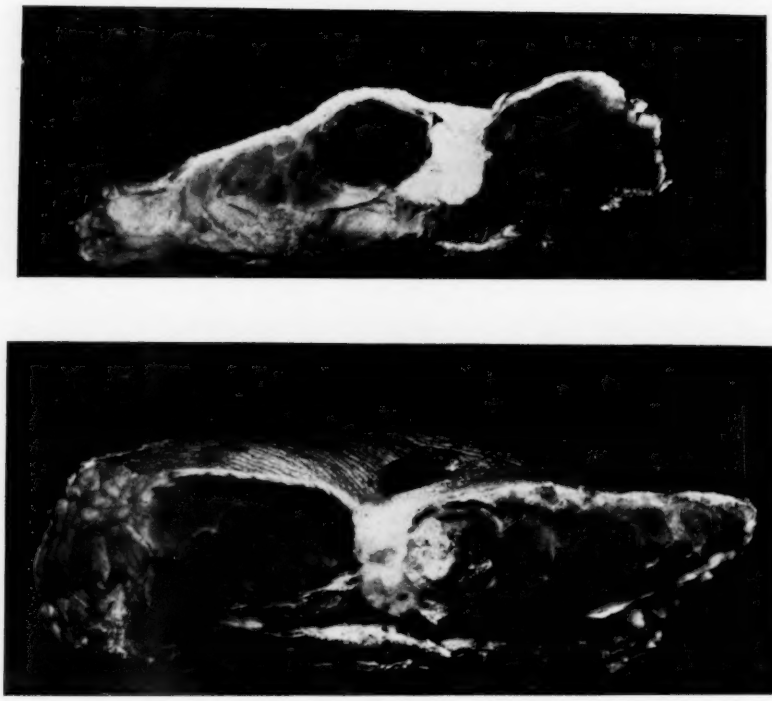

FIG. 5.—Papillary cystadenoma with adenocarcinoma. The upper photograph shows the cyst cavity to the left and the adenocarcinoma (the dense white area) on the right.

In the lower photograph the cyst cavity is seen to the right of the nipple partially filled with papillary ingrowth from the base of which the adenocarcinoma has developed. This is almost directly under the retracted nipple and is adherent to the skin.

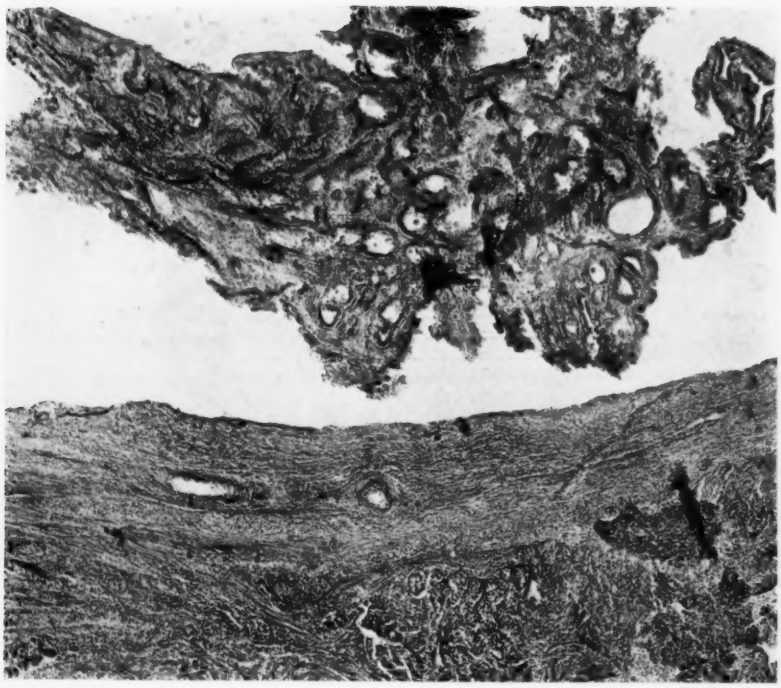

FIG. 6.—Papillary cystadenoma and adenocarcinoma. Section through the wall of a papillary cystadenoma. The cyst was situated under the nipple and was 2 cm. in diameter. It was filled with bloody fluid and contained a friable papillary ingrowth. Microscopically at the base of the papillary growth the surrounding tissue was infiltrated by the atypical glands characteristic of adenocarcinoma.

A, Papillary ingrowth.
B, Cyst cavity.
C, Cyst wall.
D, Adenocarcinoma.

with the lining of the cyst. The papillary masses were often divided into many branches and occasionally interlaced in such a way as to present the appearance of a multitude of gland tubules and ducts, lying in a fibrous stroma. The papillæ were often attached to the cyst wall at several points in their circumference. Degenerations of the connective tissue, hæmorrhagic areas and areas of œdema were not uncommon.

The epithelium appeared in many different forms. The lining of the larger cysts was commonly flattened and of several layers. That of the smaller cysts was higher and that covering the papillary outgrowths was often columnar and of different degrees of size and development varying from the familiar narrow cells of the normal ducts, to the high, columnar, well-formed cells seen in the adenomatous proliferation of abnormal involution. So far as anatomical and histological data were available, the origin of the papillary cystadenomata was in the fibrous tissue and epithelium of the walls of the larger ducts.

The degree of proliferation of the epithelium varied in different specimens and even in different portions of the same microscopic section. In one place several layers of flattened cells were found, while in others a single layer of high columnar cells alone was situated against the basement membrane.

The rate of growth of these tumors is very slow, and, as might be expected, the epithelium showed but little evidence of rapid reproduction; mitoses were occasionally seen but were comparatively rare. Degenerative processes in the papillary masses were not uncommon, and in one specimen particularly, a hyaline degeneration was observed which produced homogenous masses of varying color from red to green and black, which resembled gall-stones closely as the papillary growths lay in the opened cyst.

The cyst cavity, in addition to the polypoid tumor masses, contained serous or sanguinolent fluid, apparently from thrombosis or rupture of the vessels of the villous stalks, and in some specimens the wall of the cyst was deeply stained with blood pigment of similar origin.

With regard to the etiology of tumors of this type, very

little can be said. Trauma was cited by the patient as the supposed cause of the tumor in five cases. In eight cases no history of trauma could be obtained, and in seven no data on this point were available. So far as age is concerned, the papillary cystadenoma is generally a tumor of old age. The average age of twenty patients was 49.5 years. The extremes, however, cover a large period—the youngest patient being 19 years old and the oldest 81. It is to be noted that no gross or microscopic peculiarities were found to differentiate the tumors of young women from those of older years. The influence of marriage and lactation does not appear to be significant. One of the twenty cases was a male patient of 51 years of age. Of the nineteen women, eleven were married and eight had had children. Thus of nineteen cases of papillary tumors there were eight in women whose breasts had undergone lactation, and eleven in those which had not. Whether in development the polypoid outgrowths from the wall of the duct produce the cyst, or whether the cyst is first produced, and the papillary outgrowth is a secondary process, can only be a matter of speculation.

The symptoms of papillary cystadenoma are perhaps more characteristic and better defined than those of the majority of tumors of the breast. One or more nodules are found in the central portion of the breast, not far removed from the region of the nipple. These nodules may vary from the size of a pea to that of an orange or larger. They are generally described as hard in consistency, but if not too deep in the breast tissue, and if of sufficient size, an elastic or cystic feeling may be appreciable. One tumor was described as soft, and in a number of cases no tumor at all was felt until some time after the recognition of the bloody discharge from the nipple. The size of the tumors varied in certain of the cases, according to the amount of fluid contained, and could be diminished at will by pressure, forcing the fluid out through the nipple. Pain was present in about one-half of the cases, but was rarely severe, and was not a conspicuous symptom of these tumors, in distinction to the more painful character of abnormal involution.

The symptom which is of the greatest value in the differentiation of papillary from other tumors of the breast is the existence of a serous or bloody discharge from the nipple. This discharge was present in eleven of the twenty cases, while in four of the others the record failed to give information upon the point. It is not to be expected that discharge will always be present, as the escape of the fluid must depend on the patency of the duct between the cyst and the outer world. In one case a fistulous opening was established from the cyst through a sinus which opened at the edge of the areola, but such a condition is obviously rare.

Tumors of this type are of slow growth. The average duration of the tumor before operation was 25.8 months, the longest being eight years and the shortest one month. It is significant, however, that in three cases at least the discharge from the nipple was present for a long time prior to the discovery of the tumor.

Enlargement of the axillary glands to such an extent as to make them readily palpable is not to be expected. In two of the twenty cases the records state that enlarged glands were felt in the axilla. In the remaining eighteen, including the three cases of carcinoma, no enlarged glands were felt. It is well known that in thin persons, and as a result of irritation, enlargement of the axillary glands sufficient to make them readily palpable is not uncommon. In cases of abnormal involution this frequently occurs. The presence of slightly enlarged glands, however, is of little significance in diagnosis.

The diagnosis of tumors of this character from other tumors of the breast is facilitated by three chief symptoms——*i.e.*, the situation, under or close to the nipple; the slow, painless growth; and the presence of a discharge from the nipple of bloody fluid. As accessory symptoms it should be noted that the skin is not adherent, nor are the axillary glands enlarged.

The conditions with which these tumors are most likely to be confounded are cancer, abnormal involution and periductal tumors. From cancer they are distinguished by their

slow growth, definite outline, and by the freedom of skin, muscles, and axillary glands from involvement in the disease. Discharge from the nipple in cancer is very rare.

From abnormal involution the diagnosis is more difficult. Serous discharge from the nipple in such cases is occasionally noted. The diffuse character of this condition, however, and the irregular nodular consistency of the breasts associated with pain and tenderness are points that aid in differentiation. Involution changes also are more common in the periphery of the breast, while papillary tumors occur almost invariably near the nipple.

From periductal fibromata, the diagnosis should not be difficult. The periductal tumors occur, as a rule, at a much younger age. They are firm and elastic, often of large size, and rarely occur near the nipple. They slip and slide in the breast tissue, and never produce discharge. The periductal fibromata are far more likely to be confused with the fibrocystadenomata (the other type of the cystadenoma or epithelial group), and it is doubtful if the two can be distinguished without the aid of the gross and microscopic examination.

The prognosis of a papillary cystadenoma is uncertain. They are tumors of slow growth and may exist for years without producing serious inconvenience. By the English writers, tumors of this type have been described which in time protruded from the nipple as granular and bleeding polypi. This did not occur in any of these cases. Enlargement to such a size as to cause serious disfigurement did not occur, although one tumor as large as an orange was produced, and a fistulous opening leading to the cyst was already established when the case came under observation. There was no obvious suppuration, but it is to be supposed that infection might readily occur and be followed by necrosis and sloughing of the tumor.

As in all of the tumors of the adult breast, the chief point of interest in prognosis is the likelihood of cancer. In this series of twenty cases, cancer was present in three instances and appeared to be associated with the existence of the papillary tumor, that is, the cancerous nodule was in the wall of the

cyst, and the type of growth, adenocarcinoma, was the same in all three cases. Except for the infiltration of the surrounding tissues, the cancerous nodules presented characteristics of growth of the same general character as the papillary structures within the cyst, although the irregular cell growth and infiltration left no doubt about the diagnosis of adenocarcinoma. The occurrence of cancer, however, in fifteen per cent. of the cases of papillary cystadenoma is sufficient to warrant the early and complete removal of these tumors, and to justify their classification in a group apart from the periductal type of fibro-epithelial tumors which show no such predisposition to the occurrence of malignant disease.

The duration of the three cancer cases was 9, 12 and 18 months respectively, and their ages were 52, 69 and 76 years. Several of the cases which showed no evidence of malignant disease had been in existence for much longer periods, and in women of equally advanced years. It is perhaps worthy of note that none of the cancer cases showed the familiar symptom of discharge from the nipple, whereas it was present in all of the non-malignant tumors of more than eight months' duration of which we have specific notes. The occurrence of cancer in tumors of this character has been noted by many writers. It is undoubtedly this tendency which has led the English writers to the indiscriminate use of the word " duct-cancer " for papillary tumors of this kind. Tietze and Sasse have each described cases of this character, under the names of cystadenoma proliferum destruens malignum (Sasse) and adenocarcinoma destruens (Tietze). That a form of adenocarcinoma occurs in certain cases of papillary cystadenoma is supported by this series of cases, but that this is sharply to be differentiated from other forms of adenocarcinoma is perhaps open to question. Of the three cancer cases, two showed no evidence of recurrence at one and two years after amputation of the breast; the third case died of recurrence four years after operation. In only two cases, however, was the axilla dissected, and in these no diseased glands were found. In none of the three cases were the axillary glands palpably enlarged.

From the consideration of the course of development of papillary tumors of the breast it is obvious that radical removal of the tumor is to be advised. As in all other cases of breast tumor also, the frequency of the occurrence of cancer makes an exploratory operation the duty of the surgeon in every case of tumor in which the diagnosis cannot positively be determined to be benign and free from danger of subsequent malignancy; and the number of such cases, with the exception of the small multiple periductal fibromata, is almost nil. When the tumors are large, or multiple, amputation may be necessary to obtain complete removal; but when small and single the breast should certainly be saved. Excision may be performed from the under side of the breast by the "plastic resection" operation advised by Dr. Warren and described in the *Journal of the American Medical Association,* July 15, 1906. In some cases, however, the operation may be simplified, and a small tumor under the nipple readily removed by an incision which follows the lower border of the areola for a quarter or third of its circumference. This incision is carried through the skin alone. With retractors the wound is then drawn open in a direction radiating from the nipple, and the subsequent dissection for the removal of the tumor is carried on by radial incisions in order to avoid injury to the other ducts than the one involved in the tumor. This incision does very little damage to the breast and leaves a scar which is scarcely discernible after a month or two has elapsed.

If microscopic or gross examination of the specimen reveals the presence of carcinoma, it is obvious that a complete operation should be performed. In such a case the pectoral muscles and the axillary contents should be removed, for, although the type of cancer is of relatively low malignancy, the complete operation is only a reasonable precaution. When this is done, the prognosis should be far more favorable than in the average case of cancer of the breast.

Of the seventeen cases of non-malignant tumor in this series, seven had an amputation of the breast, eight had the tumor excised by a plastic or direct incision, and two by the

areola incision. In one of the amputation cases the axilla was also dissected. The results of these operations were as follows:

Of the seven amputation cases, one patient could not be traced, five were free from disease at periods of one, one and a half, two, three and eight years after operation, and one died of old age and debility three years after operation without recurrence.

Of the ten excisions, three were untraced, one showed a local recurrence of the tumor after six months, which has persisted for three and a half years without further increase; another showed a local recurrence eighteen months after operation, which was removed, and the patient has not since reported. The other five cases were examined or reported free from disease at periods of one and a half, three, six, and eighteen months, and four years after operation. Of the two cases of recurrence, one was proved by microscopic examination to be similar to the original tumor and non-malignant, and the other had existed without change for three and a half years, so that the presumption is fair that complete removal of the original tumor was not obtained at the first excision. It is obvious that this should be done in every case, even if amputation is required; but we believe that so radical a procedure is rarely needed.

SUMMARY.

Twenty breast tumors of the papillary cystadenoma type showed the following characteristics:

(1) They were single or multiple, involving the large ducts near the nipple, and composed of one or more cyst cavities from the walls of which grew papillary outgrowths composed of a fibrous tissue stroma and a luxuriant growth of duct epithelium in the form of irregular gland tubules and polypoid projections.

(2) Tumors of this character have been described by many names, viz. adenoma, duct papilloma, duct cancer, villous papilloma, cystadenoma intracanaliculare, proliferous cysts, etc.

(3) They occur in the male breast as well as in the female.

(4) They occur at all adult ages and independent of trauma, marriage or lactation.

(5) They are usually painless.

(6) They are generally situated near to or beneath the nipple.

(7) They are usually of small size, but occasionally attain the dimensions of an orange.

(8) They are of slow growth.

(9) Their most characteristic symptom is the presence of a discharge from the nipple which may be serous, but is usually bloody in character.

(10) Do not cause enlargement of the axillary glands.

(11) Fifteen per cent. of the twenty cases in this series were associated with a form of cancer (adenocarcinoma) of a relatively low type of malignancy.

(12) Treatment demands the complete removal of the tumor, either by excision or, if necessary, amputation of the breast.

(13) Excision may be performed by plastic resection or by an areola incision.

(14) The association of cancer with papillary cystadenoma in fifteen per cent. of the cases justifies the separation of this group from other fibro-epithelial tumors of the breast in clinical and pathological classification.

ABSTRACT OF CASES.

I. No. 123. 1896. Dr. J. W. Elliot (ix–180). Female, 57. Married, 1 child. 2 months' duration. Tumor, size of walnut. Right breast. Upper outer quadrant, no pain; discharge not recorded. Excised. Recurrence 2 years later. Same situation. Size of hen's egg. Excised. Both papillary cystadenoma. No later report.

II. No. 11. 1896. Dr. J. C. Warren (320–44). Female, 44. Single. 6 years' duration. Tumor, 2 inches in diameter. Left breast. Upper half. Pain slight. Discharge from nipple for 10 years. Excised. Papillary cystadenoma. No later report.

III. No. 65. 1897. Dr. H. H. A. Beach (325–211). Female, 52. Married, 1 child. 11 years' duration. Tumor, 3 inches in diameter, under nipple. No pain. Discharge not recorded. Excised. Papillary cystadenoma. No further report.

IV. No. 15. 1895. Dr. A. T. Cabot (334–70). Female, 61. Single. 9 months' duration. Tumor, size of orange. Left breast, under nipple. No pain. Discharge not recorded. Amputation. Papillary cystadenoma. 1906, reports no further trouble.

V. No. 91. 1900. Dr. H. H. A. Beach (339–2). Female, 57. Widow. 2 miscarriages. 1 months' duration. Tumor, size of hazel nut, under nipple. Pain slight. Discharge serous for 10 years. Bloody in last 12 months. Excision. Papillary cystadenoma. No later report.

VI. No. 217. 1901. Dr. J. C. Warren. Female, 81, single. Tumor, size 3 cm., near nipple. Slight pain. No discharge. Amputation. Papillary cystadenoma. Died 3½ years later of old age and debility. No trouble with breast.

VII. No. 166. 1902. Dr. A. T. Cabot (li–220). Female, 42. Married. 6 children, 1 miscarriage. Normal lactation. 1½ years duration. Tumor size almond, under nipple. Slight pain. Discharge brownish and bloody for 3 years. Excision. Papillary cystadenoma. Tumor recurred in same situation and has persisted for 4 years. No further operation.

VIII. No. 171. 1902. Dr. W. M. Conant (lix–14). Female, 45. Married, 8 children; 2 miscarriages. Breast abscess on other side 2 years ago. 6 months' duration. Tumor under nipple. No pain. Discharge bloody on pressure. Excised. Papillary cystadenoma. Report, 4 years later, no trouble.

IX. No. 184. 1903. Dr. W. M. Conant (lxxxi–295). Female, 35. Married, 8 children. 1 year's duration. Tumor size of chestnut, under nipple. No pain. Bloody discharge. Amputation. Examination, 4 years later. No trouble.

X. No. 204. 1904. Dr. S. J. Mixter (469–145). Female, 67. Married, children? Duration 2 years. Tumor, size of egg, near nipple. No pain. Discharge not recorded. Amputation. Papillary cystadenoma. Reports, 3 years later, no trouble.

XI. No. 210. 1905. Dr. C. A. Porter. Female, 43. Married, 4 children. 4 years' duration. Tumor, size of small orange, near nipple. Sinus at edge of areola. Painful of late. Discharge from sinus watery and bloody. Amputation. Papillary cystadenoma. Report, 18 months, no trouble.

XII. No. 209. 1905. Dr. R. B. Greenough (42–352). Female, 19. Single. 1½ years duration. Tumor, size of half a hen's egg. No pain. Bloody discharge from nipple. Excision by areola incision. Papillary cystadenoma.. 19 months later, examination, no further trouble.

XIII. No. 211. 1905. Dr. Wm. M. Conant. Male, 51. 4 months' duration. Tumor size of walnut. Upper outer quadrant. Pain not marked. Bloody discharge from nipple on pressure. Amputation with dissection of axilla. Papillary cystadenoma. Examination, 16 months later, no trouble.

XIV. No. 205. 1906. Dr. S. J. Mixter. Female, 24. Single, 4 years' duration. Tumor size of lemon, under nipple. Slight pain at time of catamenia. Discharge from nipple bloody and purulent(?). Excision. Papillary cystadenoma. No later report.

XV. No. 206. 1906. Dr. J. C. Warren. Female, 34. Married, no children. 8 years' duration. Tumor, size of walnut. Right breast; lower inner quadrant. No pain. Discharge not noted. Plastic resection. Periductal fibroma and papillary cystadenoma. 6 months later, result perfect.

XVI. No. 208. 1906. Dr. F. G. Balch. Female, 30. Single. 4 months' duration. Tumor, size of walnut, under nipple. Considerable pain. No discharge. Excision with areola incision. Papillary cystadenoma. Result, 3 months later, perfect.

XVII. No. 212. 1906. Dr. C. L. Scudder. Female, 40 Single. 7 years' duration. No pain. Bloody and serous discharge. Plastic resection. Papillary cystadenoma. No later report.

XVIII. No. 216. 1898. Dr. S. J. Mixter (333–177). Female, 52. Married, no children. 9 months' duration. Tumor, 2 inches in diameter, near nipple. Pain slight. Discharge not recorded. Nipple retracted. Skin adherent. No glands felt in axilla. Amputation. Papillary cystadenoma and adenocarcinoma. Died four years later of cancer of the breast.

XIX. No. 215. 1901. Dr. H. H. A. Beach (385–136). Female, 76. Widow, 2 children. 1 year duration. Tumor, size of walnut; upper inner quadrant. No pain; non-adherent. No gland felt in axilla. Amputation. Axilla not dissected. Papillary cystadenoma and adenocarcinoma. Report, 1 year later, no recurrence.

XX. No. 214. 1905. Dr. J. C. Warren. Female, 69. Single. 18 months' duration. Tumor, size of walnut, under nipple. Adherent to skin. No glands felt in axilla. Slight pain. No discharge. Complete amputation. Axilla not dissected. Papillary cystadenoma and adenocarcinoma. 2 years later, examination showed no recurrence.

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PUERPERAL GENERAL PERITONITIS,

REPORT OF ELEVEN CASES.

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THE problems of puerperal infection are still unsolved and, since the introduction of aseptic methods into obstetric practice, no great advance has been made in the prevention and treatment of the condition. While women continue to lose their lives in such large numbers from this condition, little help has been offered by investigation. This disease annually accounts for thousands of deaths in this country, and is more worthy of study than many more abstruse but less important problems investigated by special committees and under special grants.

The course of puerperal infection shows but little difference from that of severe infection in other parts of the body. The great severity of the condition is due to several factors. The pregnant woman is more susceptible to infection, in general, than the non-pregnant, and is prone to disturbances of metabolism which lessen resistance and decrease elimination. The traumatism of labor causes a local disturbance of circulation and the raw surface of the uterus bares a huge surface for the entrance and growth of micro-organisms. The anatomical relations and blood supply of the organs have been temporarily altered and an easy portal of infection is presented by the genital parts of the recently pregnant woman.

Puerperal infection shows varied manifestations and, in itself, is not a sufficient diagnosis of a condition whose varied phases require different treatment. The clinical evidences of puerperal infection are those of a rapidly advancing genital infection. The endometrium, in the majority of cases, is the point of entrance of the micro-organisms and their products. Wounds of the perineum and vagina may become infected but, as a rule, the infection here remains local. If the endome-

trium is the seat of the infection, the micro-organism spreads into the veins and lymphatics and may gain entrance to the general circulation. This is the common course of streptococcus puerperal infection. In this form of infection, the essential lesion is a peri-uterine lymphangitis. This lymphangitis follows a similar course to the common and well known streptococcus infection of the arm, save that it is modified by the more generous lymphatic and blood supply and an adjacent serous membrane—the peritoneum.

This lymphangitis is more commonly associated with thrombosis than with the presence of actual pus in the lymphatics, which is a result only in severe cases, and accounts for Trendelenberg's [1] findings of thrombosis of the uterine and spermatic veins in 21 out of 43 fatal cases, and lymphatic infection in only four. Grossman,[2] in a study of 51 post-mortem examinations in puerperal infection, found peri-uterine thrombo-phlebitis alone in fourteen instances, and associated with lymphangitis in 13 other cases. However, the frequency of peritonitis, which must be from direct lymphatic extension, shows that the condition is more common than the post-mortem records show. The thrombosis of the peri-uterine veins is a matter of secondary consideration and a comparatively unimportant complication of the disease. The essential lesion is a spreading lymphangitis following the course of lymphangitis elsewhere in the body.

Cuff [3] has recorded a case in which laparotomy was done, of a severe puerperal infection with rigors and very high temperature. There was, on vaginal examination, a mass on the right side of the uterus which proved to be the broad ligament, " the thickness of three fingers stretching from the uterus wall internally to the pelvic wall externally." The ovarian vein was tied and the patient recovered. While assisting Noble of Philadelphia, I saw two such cases of puerperal infection in which the broad ligament was thickened, respectively, to one and to two and half fingers in breadth. Both cases got well after closure of the abdomen without further surgical treatment. There was no abdominal pus in either Cuff's case or the two referred to. This condition is, however, a preliminary state

before peritoneal infection. However, the condition may subside before peritoneal infection results, and become spontaneously cured.

This form of peritonitis is usually streptococcic and is marked by severe clinical manifestations, with little evidence of effort at repair on the part of the peritoneum. The local seat of the disease is about the broad ligaments and the pus is found generally distributed within the abdominal cavity, with little or no evidence of repair in the distant parts. Intestinal paralysis soon follows and the streptococcic form of the disease is almost always fatal. Sargent [4] believes that no recoveries follow this type of peritonitis, but I have seen two cases of general peritoneal infection with streptococcus recover after a simple laparotomy and drainage.

While this type of peritonitis is a most common one in the puerperium, there are other forms in which the infecting organism does not pass through the genital canal, but is the result of the lighting up of a previous focus of infection. Into this class fall all cases of infection from bruising of tumors, rupture of pus tubes, or purulent collections about the adjacent pelvic organs. Any variety of a pelvic tumor may be bruised or have its blood supply cut off by torsion at the pedicle and become inflamed and gangrenous, thus setting up a peritonitis. The important point to recognize is that, in this form, the lymphatics are not involved, and that the treatment is that of a non-puerperal peritonitis from a similar cause. However, it frequently happens, particularly in infection from pus tubes, that there may be associated two infections, one of which is of the nature of a lymphangitis, and the other is the old infected focus lighted up. Thus, as occurred in one of my cases, an old purulent gonorrhœal salpingitis may become reinfected with streptococci by lymphatic extension and form pus collections. This may rupture, causing a general peritonitis. In this way it will be seen that it is difficult to make hard and fast subdivisions between lymphatic puerperal peritonitis and peritonitis from previous infection.

While the streptococcus is the most common cause of lymphatic peritonitis, other organisms also have a share in its

production. The streptococcus is the most frequent cause of puerperal infection, and in a previous paper [5] it was estimated to be the causative organism in 40 per cent. of all cases.

In more recent communications on this subject, Lloyd,[6] in 159 cases, says streptococci were found in 33 cases, staphylococci in 30 cases, pneumococci in 17 cases, gonococci in 21, colon bacilli in 22 cases and bacillus capsulatus ærogenes in 2 cases. While these statistics are based upon a study of the infection in the puerperium, it has also been shown that the streptococcus is a frequent cause of infection in premature labor and abortion.

The frequency of the incidence of the various infecting organisms, is shown by the following table of eleven cases, in which they occur in about the usual ratio:

TABLE OF CASES.*

Case.	Local Lesions.	Character of Peritonitis.	Complications.	Organisms.
I	Acute hæmorrhagic endometritis.	Acute suppurative.	Acute suppurative endocarditis; septic pneumonia.	Staphylococcus aureus.
II	Abortion; acute suppurative endometritis.	Acute purulent.	Acute suppurative salpingitis.	Pneumococcus.
III	Premature labor.	Acute purulent.	Bilateral gonorrhœal salpingitis.	B. coli; streptococcus; gonococcus.
IV	Abortion; gangrenous endometritis.	Acute purulent, with petechial hæmorrhages.	Acute yellow atrophy of liver.	Streptococcus; B. capsulatus ærogenes.
V	Acute exudative endometritis.	Acute plastic.	Salpingitis; hydrosalpinx.	Streptococcus.
VI	.....	General plastic.	Pyosalpinx.	Streptococcus.
VII	Purulent endometritis.	Acute purulent.	.....	Streptococcus; B. coli.
VIII	Acute endometritis.	Acute purulent.	Abscess of cul-de-sac.	Streptococcus.
IX	Acute purulent endometritis.	Fibro-purulent.	Pericarditis.	Staphylococcus aureus.
X	Acute purulent endometritis.	Acute purulent.	.....	Streptococcus.
XI	.....	Acute purulent, with multiple local collections.	Bilateral purulent salpingitis.	Gonococcus.

* Some of these cases have been referred to before in other communications. A number of them were studied in the Bender Laboratory and some are from the records of that place. Others were studied at the N. Y. Lying-in Hospital and Kensington Hospital for Women.

These cases show that the streptococcus was the infecting organism alone in 3 cases, and associated with other bacilli in 3 cases. Thus, it will be seen that the streptococcus occupies a greater share as a cause of puerperal peritonitis than it does of puerperal infection in general. Also, Sargent [4] states that, in a study of 258 cases of peritoneal lesions, the staphylococcus albus was found in 108 cases; and he states that this and the colon bacillus form the most important and frequent causative organism concerned in peritonitis, outside of pregnancy. In the cases in which streptococcus was concerned, there were very acute symptoms and marked clinical disturbances. The course was fulminating, and was associated with marked anatomical disturbances in other parts of the body.

Case III, a case of premature labor at the sixth month, showed few symptoms until the seventh day, when there was a high temperature of 104°, with abdominal tenderness and rigidity. The uterus seemed well involuted and there was profuse purulent discharge. The physical examination showed a moderate sized fixed mass on the right side of the uterus. No swelling or mass in the cul-de-sac. The uterine discharge contained the gonococcus and streptococcus. The leukocyte count at this time was 29,000, with 90.5 per cent. polynuclears. On the ninth day after delivery, the patient was taken with sudden severe abdominal pains and marked tenderness and rigidity. The pain was peristaltic in character, intermittent and intense. The tongue was dry and there was slight vomiting. The physical examination showed fulness in the cul-de-sac, with marked tenderness and a disappearance of the mass on the right side; leukocyte count was 11,000, with 90 per cent. polynuclears. Laparotomy showed general distribution of sero-purulent fluid with marked congestion and redness of the viscera. This is most marked in the pelvic region. The right tube had formed part of the wall of an abscess beside the uterus and pus exuded from the fimbriated end and from the cut surface of the broad ligament. Death occurred nine hours after rupture of the abscess. The gonococcus, streptococcus and colon bacillus were recovered from the abdominal fluid.

Case IV was one of criminal abortion at the seventh month, and was seen five days after labor. The pulse was 140 and temperature 102°. There was slight jaundice. The leukocyte count was 19,000, and the polynuclears 86 per cent. Vomiting was continuous until stupor intervened and increased to coma. The patient died on the fifth day after the operation. The autopsy showed acute yellow atrophy of the liver, with general peritonitis. In the fluid was found the streptococcus and B. capsulatus ærogenes.

Case V was one in which streptococcic infection was associated with an old pyosalpinx; this caused an acute peritonitis, more marked in the lower part of the abdominal cavity, but which invaded the upper part as well. There was little pus. The hydrosalpinx on the left side was uninfected.

Case VI was a similar case to Case V, save that the peritonitial infection was not as acute, and there had been some attempt at repair by adhesions.

Case VII showed general peritonitis with a large amount of pus containing colon bacilli and streptococci. This followed upon an acute purulent endometritis. Death occurred on the tenth day.

Case X was a similar case, being marked by severe vomiting, a high temperature of 105° and intense pain and rigidity. Death occurred on the ninth day.

While the cases of streptococcus infection showed severe symptoms, the cases of infection with staphylococcus aureus also showed acute clinical manifestations with marked anatomical lesions. In this series the staphylococcus aureus was present in two cases.

In the study of puerperal infection, the staphylococcus aureus has been seldom isolated. Fullerton and Bonney [7] have found this organism in one out of 54 cases. Lloyd,[6] in a study of 159 cases, found staphylococcus in 30. The type of infection with this organism seems to be one of great severity, with a tendency toward pyemia and the production of metastatic abscesses.

Such was the result in Case I where, after an apparently

normal pregnancy, the patient was delivered by a midwife. She was seen on the eighth day of the puerperium, profoundly infected. There was marked tenderness and rigidity. Temperature was 104.3°. Death occurred on the next day. No operative measures were attempted. Post-mortem examination showed a large quantity of peritoneal pus with a dull injected peritoneum covered with a small amount of fibrin. The pericardial cavity also contained pus. There were areas of septic pneumonia. Bacteriological examination of the organs and pus showed staphylococcus pyogenes aureus.

Case IX was somewhat similar but ran a more prolonged course. The patient entered the hospital on the eighteenth day and succumbed to the profound infection on the same day. Autopsy showed a pericarditis, empyema and general peritonitis with little evidence of repair. The broad ligaments were thickened and firm and there was macroscopic evidence of lymphangitis, pus exuding from the cut surface of the broad ligament. In these two cases, the tendency of staphylococcus infection toward extension to the neighboring cavities and metastatic abscesses is well shown.

Gonorrhœal infection is one of the most common varieties of infection in the puerperium, and is the least frequently discovered. It usually causes little or no rise of temperature, but may cause high fever, serious morbid disturbances and death. Stone and myself [8] found the gonococcus in the lochia of puerperal women in 17 out of 171 cases. This organism was associated with peritonitis in only one case of that series. This is Case III, in which there was a bilateral purulent salpingitis from gonorrhœal infection and, following upon this, lymphatic peritonitis from the streptococcus, rupture of an abscess and general peritoneal infection.

Case XI was one of gonorrhœal infection of the uterus with extension to the tubes and peritoneum. In this case, there was a lesion of gonorrhœal infection before pregnancy, and the disease followed its usual course of rapid extension in the puerperium. The temperature went to 101° and the third day of the puerperium, the pulse was 96. The gonococ-

cus was isolated from the vaginal discharge. Pain, rigidity and a temperature of 103.6° appeared on the fifth day. On the sixth day, indefinite masses in the abdomen and pelvis were made out on abdominal and vaginal examination. Pulse at this time was 120. Pulse and temperature kept high until the seventeenth day when death occurred. Operation was refused. Autopsy showed bilateral purulent salpingitis and a general peritonitis of some duration. Collections of pus were found encapsulated by intestines and adhesions in various parts of the abdomen. The gonococcus was isolated in pure culture. Mann [9] has reported a somewhat similar case, in which the symptoms came on the tenth day. Temperature was 107°, pulse 120. Death occurred and the post-mortem examination showed a peritonitis from pure gonococcus infection.

Gonorrhœal infection usually extends by direct continuity of mucous membrane, but may, in the soft condition of the genitalia, penetrate the uterine muscle and extend into the broad ligament. Salpingitis is a frequent complication of this infection in the puerperium, as is shown by the study of Stone and myself,[8] in which we found clinical evidence of extension of the infection beyond the uterus, in 7 out of 17 cases. This extension of the disease may continue, as in Cases III and XI, to cause a peritonitis which is, however, usually localized in the cul-de-sac. The late complications of gonorrhœal infection are more to be feared than is the earlier uncommon general peritonitis. Salpingitis and pelvic peritonitis are the most common results. This is the cause of "one child sterility."

Pneumococcus infection is one of the more uncommon forms of puerperal peritoneal infection, and one of comparatively slight severity, save in isolated cases, as in Case II. This condition resulted in a woman four months pregnant, following an induced abortion. She was seen five days after the induction and was curetted for retained secundines. The pneumococcus was isolated from smears and cultures taken at the time of curettage. The temperature was 102 and continued high until death three days afterwards from peritonitis.

Post-mortem examination showed all the peritoneal sur-

faces to be covered by a sticky, greenish-yellow purulent exudate which was thin between the adherent intestines, but thick between surfaces held apart by collections of fluid. All the dependent parts of the abdomen contained yellowish turbid fibrino-purulent exudate. There was an acute suppurative salpingitis and endometritis. The pneumococcus was recovered from the peritoneal exudate.

While pneumococcus puerperal infection is uncommon, a number of cases have recently been reported. Weichelbaum [10] as well as Bar and Tissier,[11] have reported cases; and Cohn one similar to this. Fullerton and Bonney [7] found six cases of pneumococcic infection in 54 cases of puerperal fever; and Lloyd [6] found the pneumococcus in 17 out of 159 cases of puerperal infection. The pneumococcus is being more frequently isolated in such conditions, as the bacteriological methods of study improve. That the condition is by no means rare as a cause of infection of the peritoneum, is shown by Annand's and Bowen's [12] collection of 91 cases of pneumococcus peritonitis in children. They found that in half the cases the pus was encysted and that the peritoneal infection was usually secondary to some remote pneumococcal lesion. The exhaustive discussion by Jensen [13] of this form of peritonitis, gives a thorough idea of the subject. He reports several very interesting cases and gives a list of 143 references.

The character of this form of peritoneal infection is usually that of Case II, reported here. The infection is characterized by a plastic exudate, very rich in fibrin, which causes adhesions and encapsulation of the exudate; quite rarely, in the severer forms, the entire mass of the intestines adhere together and are surrounded by pus. In typical cases, the clinical picture is quite striking; the onset is that of an acute peritonitis, followed, very soon, by a chronic stage with mild symptoms and indefinite masses on abdominal palpation. The diagnosis is never certain without bacteriological examination, although one might suspect this infection from the thin, odorless, greenish-yellow pus and the abundant fibrinous adhesions. The prognosis is, as a rule, favorable; but recovery without

operation is rare. Simple evacuation of pus and drainage of the collections are all that is usually required.

There is, in this series of cases, no instance of peritoneal infection resulting from direct traumatism or necrosis of a tumor from pressure or torsion of the pedicle. A fibroid or ovarian cyst may take on rapid growth during pregnancy, and from torsion of the pedicle or sudden loss of nourishment from lessening of the blood supply after labor may become necrotic and infected. Lepage and Mouchotte [14] have collected a number of such cases. Similar causes lead to infection from ovarian cysts; and Getter [15] has reported 21 cases where, in spite of normal labors, infection of the cyst has occurred and led to fatal peritonitis. The infection is commonly due to the colon bacillus and is usually widespread and severe. Lawrence has reported ten such cases sent to the hospital as peritonitis following a puerperal genital infection. Patton [17] has collected 321 cases of ovarian cysts in pregnancy. In 95 cases treated expectantly until labor, torsion of the pedicle occurred 29 times—4 times during labor and 25 times during the puerperium. Rupture happened 13 times—3 before and 10 after or during labor. There were 25 deaths in the 95 cases, only 4 of which occurred in patients who had operations after labor, and 21 in those who were treated wholly expectantly. General peritonitis occurred in 7 of the 95 cases. There were 184 cases treated by operation, with a mortality of 8 (4.3 per cent.). Infection of ovarian cysts is especially likely to happen in the early puerperium. The teratoid ovarian tumors are particularly liable to be aroused from quiescence to rapid growth during pregnancy. This is well shown by a review of 35 cases by Neuhauser.[18]

Appendicitis is another lesion which may cause an extensive and fatal form of peritonitis in pregnancy and the puerperium.

The lessened resistance to infection of the pregnant woman has added to it the local abdominal disturbances of the presence of the mass of the gravid uterus and the increased vascularity of the pelvic viscera. Futh,[19] in his recent papers, up-

holds Waldeyer's statement that the cæcum and appendix are pushed up during pregnancy. This displacement begins about the fourth month, when the uterus rises out of the true pelvis. It then opens up the broad ligaments and the ovarian vessels are enormously increased in size. This elevation of the cæcum is of clinical significance as, in addition to predisposition to disease by reason of the alteration of position, the focus of inflammation is thereby placed in a more dangerous position—*i.e.*, higher in the abdomen, where adhesions are more easily torn and where inflammatory processes spread with greater ease. The cæcum returns to its proper place after labor; but, if the appendix is adherent to the uterus or adnexa, it is dragged into the true pelvis by the involution of the uterus. This may cause rupture of an abscess and increase the extent of the inflammation to the general peritoneum.

Seven casts of the abdominal cavity of women, dying during pregnancy, are described by Futh [20] to uphold this view. Five cases of appendicitis in pregnancy are also reported, and he states that appendicitis is much more dangerous after the fourth month, on account of the size of the uterus influencing the position of the cæcum. He has divided Boije's series into two groups. In the first, under four months, there were 10 cases, with three deaths. In the second, from the fourth to the ninth month, there were 32 cases with 19 deaths—a much higher mortality. This seems to be clear proof of the effect of the continuance of pregnancy upon the mortality of this condition. Hlawecek,[21] in 1897, collected 13 cases of peritonitis from this cause with 11 deaths; but under early operative treatment, the prognosis is brighter.

The diagnosis of generalized peritonitis in the puerperium is by no means easy. The extension of an infection in a woman already severely infected, shows few additional symptoms and small increase of pathognomonic signs. The diagnosis of puerperal genital infection is in itself not always easy, and the presence of pathogenic micro-organisms in the lochia is not proof of infection. Bumm and Sigwart [22] found that, by very careful examination, the streptococcus was isolated in the

vaginal discharge of 38 per cent. of women in the later months of pregnancy. Leo,[23] in an examination of the lochia in 38 normal women, in the puerperium, found the streptococcus in the vagina in 50 per cent. and in the uterine lochia in 17.6 per cent. In the later days of the puerperium, streptococcus is more commonly found, as was shown by a study of Schenk and Schieb,[24] who found this organism four times more frequently late in the puerperium than at the beginning. They found that streptococci existed in the lochia of one-third of all normal women. Also the discovery of a certain organism in the vagina, although an indication is not pathognomonic of the cause of infection. Sargent [4] reports a case of gonococcus infection found in the vagina while the peritoneum was infected with the pneumococcus. Stone and myself [25] have shown, in a study of the gonococcus, that this organism may exist in the uterine lochia without causing temperature. However, the presence of certain bacteria in the uterine lochia, as shown by smears and cultures, is some indication of the cause of infection.

The time at which the extension of the infection to the peritoneum occurs seems to be very variable. Lymphatic peritonitis from streptococcus usually appears from the third to the tenth day of the puerperium. It is seldom earlier but often later. The time of onset of symptoms of peritonitis from previous lesions also varies within a wide limit, but is usually later in appearance than the lymphatic form.

Pain is usually a prominent symptom, and occurred in all my cases. The pain of peritonitis is, I believe, fairly characteristic, and is a great aid in the diagnosis of the condition. It depends upon two conditions: First, it is now recognized that most of the pain in peritonitis is due to an accompanying lymphangitis. This, in part, causes the crampy pains of peritonitis—the lymph vessels of the intestines press upon the sensory nerves as the lymphangitis extends. The pain in the lymphatic peritonitis is not usually localized, as in appendicitis, but is sometimes referred, like that of appendicitis, to the epigastrium. This is supposed to be due to the infection in the peri-lymphatic tissue and the lymph glands around the aorta.

There seems to be but little pain from lymphangitis of the broad ligament.

The second source of pain is from the exterior of the gut itself, and is due to the presence of an irritant causing an inflammation of the peritoneum. The movement of the intestine causes severe crampy pains. That this pain is due somewhat to the irritant, and not directly to the inflammation, is shown by a case of abdominal hæmorrhage following Cæsarian hysterectomy upon which I did a laparotomy to control the bleeding. After clean hysterectomy there was a sudden flow of blood into the peritoneal cavity. The patient, who had been resting quietly, immediately complained of intense pain in the epigastrium and in the diaphragmatic region, generally. There was difficulty in breathing and nausea. The pain was intermittent and intense. Immediate laparotomy showed that the unclotted blod was generally distributed throughout the abdominal cavity. The character of the pain was similar to that of Case III, in which there was a sudden rupture of a pus collection, causing intense intermittent pain, crampy or peristaltic in character. In addition to the direct irritation and inflammation of the peritoneum, the pain is further caused by the rubbing of the inflamed intestinal covering against the parietal peritoneum. The visceral serosa has comparatively few sensory nerves while the parietal peritoneum is exceptionally well supplied. The pain in the diaphragmatic region, in the two cases cited, was probably due to irritation of the parietal serosa in the area. It is also recognized, however, that peritonitis may exist in the center of the belly, beneath the colon and above the pelvis, amongst the coils of the small intestine, for some time and become widespread without causing marked pain.

That acute abdominal symptoms may be caused by a lymphangitis alone, is shown by a report of Rowland,[26] of two cases of operation upon supposed perforation in typhoid fever. Masses of enlarged lymphatic glands were found in the mesentery of the gut without any evidence of perforation or peritonitis. The pain was intermittent and peristaltic. There was

localization of the tenderness with little or no rigidity. Armstrong [27] has reported a similar case in typhoid fever; and McCrae,[28] in his study of the pain in typhoid fever, cites two cases in which the explanation for the acute symptoms was the enlarged mesenteric glands.

In peritonitis, while the intestines are quiet, pain is not usually a marked feature; but, during peristalsis, it is usually present. For this reason, it is often useful for diagnostic purposes to set up peristalsis and elicit the pain by giving a purgative enema. This usually also gives a clue to the location of the point of greatest inflammation.

Rigidity is usually an early and trustworthy sign. It is present in all cases of peritonitis which were seen at their inception. It was present in the 7 cases of localized gonorrhœal peritonitis, before referred to. Rigidity, however, depends, in some measure, upon the suddenness of the onset of the peritonitis and sometimes does not last long. Intestinal distension usually overcomes it and causes it to disappear. To the educated hand of the surgeon, it is the most reliable early symptom.

Tenderness on palpation is not usually a marked symptom unless there has been marked effort at repair and the formation of much exudate and many adhesions. It may sometimes be produced vaginally by movement of the uterus. It can also be elicited after peristalsis has been set up.

Vomiting is a fairly constant symptom and occurs at two different periods in the disease. First, at the onset, there is usually vomiting, regurgitative in character, and later there is more persistent bile-stained vomiting, often fæcal or hæmorrhagic in character.

The temperature was rather variable in character. In the infection with the more virulent organisms, it went very high and was intermittent in character; but in the last days of the disease, this intermission was not present. In the less virulent infection by gonococcus and pneumococcus, the temperature while high, did not rise above 103°. The pulse in these two instances was also lower than in the more virulent

form. There was, however, nothing characteristic about the less virulent peritonitis. In Case III, after rupture of the abscess, the pulse suddenly rose from 90 to 120 and became of high tension and thready. The pulse is usually a better indication of the condition of the patient than is the amount of fever.

The blood changes of general peritonitis are interesting and instructive. There is usually a diminution in the red cells. This is more marked in puerperal peritonitis, and, in puerperal infections generally, than in infection in the non-pregnant. The leukocyte count is increased as it is in all septic conditions. This depends upon many conditions, as the patient's resistance and the virulence of the infection. It may be said that, as a general rule, in streptococcus infection, the leukocyte count is less in the pregnant than in the non-pregnant. A sudden fall in the leukocyte count (as in Case III, from 29,000 to 11,000) is suggestive of an overpowering of the system by toxins of the infective organisms. The polymorphonuclear leukocytes are usually increased in percentage.

Iodophilia is another useful sign and gives reliable evidence in all septic conditions. After staining with weak solution of iodine (Ehrlich's method), the blood, in cases of septic infection, usually shows a reaction in the cytoplasm of the leukocytes. This iodophilia usually occurs in the polymorphonuclear neutrophile cells and sometimes in the lymphocytes. It does not bear a definite relation to the leukocytosis; but depends upon the amount of toxemia, not upon the leukocyte range. Thus, the blood of a profoundly septic person may show intense iodophilia with a fall in the leukocyte count; while a high leukocytosis, without iodophilia, is not incompatible with an infection exciting a toxæmia sufficient to stimulate the cells to overproduction, but not of a character to affect them structurally. This fact makes the reaction especially valuable in cases of puerperal peritonitis, where there is often sudden overpowering of the system by toxins. An interesting review of the work of Cabot, Locke,[29] Dunham,[30] Dunn [31] and Keen [32] upon this subject is given by Da Costa,[33] with a report

of 100 cases, including 30 cases of sepsis in which the iodophilia was present.

It must be remembered, however, that the diagnosis of peritonitis can never depend upon the blood changes which only give confirmative evidence of infective processes. No hard and fast rule in regard to the degree of leukocytosis can be laid down, in spite of efforts of some of the camp followers of scientific investigation to have us diagnose our cases of sepsis in their private laboratories.

The bacteriology of the blood and lochia is of importance in forming an exact idea of the extent and character of the infection. Smears of the uterine lochia often give immediate and useful information in regard to the possible cause of the peritonitis.

Careful physical examination should be made upon all cases of suspected puerperal peritonitis, as it is the exception and not the rule for all patients with severe puerperal peritonitis to be without complications and infection in other organs. Care should be taken to recognize lung and heart complications, and search should be made for metastatic collections. Pyelitis and pyonephrosis are also not uncommon results of infection in pregnancy. The use of the Pravaz or Hollenbeck [34] needle has been suggested for the detection of free pus in the abdominal cavity, but should be used with great care, as there may be adhesions which would cause the bowel to be punctured.

The treatment of uncomplicated puerperal peritonitis is that of peritonitis in the non-pregnant. Immediate laparotomy and evacuation of the purulent matter with removal of the focus of infection, if possible, is recognized by all surgeons to be the proper procedure. While this is true in all cases in which peritoneal infection has resulted from previous foci as pus tubes, abscesses or necrosis of tumors, there is more difference of opinion as regards the value of operation and the procedure in lymphatic peritonitis.

Trendelenberg has advised, in this condition, resection or ligature of the veins of the broad ligament. It is decidedly

questionable whether this operation has any great value, as cases are noted in which recovery has taken place after simple laparotomy. The thrombosis of the veins is merely an incident of the infection, and offers no excuse for the laceration of the broad ligament and the division of the lymphatic channels, to allow the escape of micro-organisms. Hysterectomy, an operation which has been practically abandoned unless there is a local lesion, has more raison d'etre, for it removed a greater part of the infected surface and allowed of better drainage.

In order to thoroughly discuss operative measures in the lymphatic form of general puerperal peritonitis, a proper knowledge of the processes of infection with the most common causative organism, the streptococcus, is necessary. Streptococcus infection differs from most other infections in that the blood serum does not acquire streptococcidal properties, but the destruction of the cocci and relief from the infection is brought about by the leukocytes. There is a relatively small amount of toxin developed and no bactericidal properties in the serum, and it is reasonable to suppose that phagocytosis is an important factor in recovery. In addition to a leukocytosis, there must be an increase in the opsonin, *i.e.*, an increase in the power which prepares the leukocytes to engulf the bacteria. Any substance, then, which aids the body defenses to resist the infection is of use.

Anti-streptococcic sera have been tried for many years with poor results; but recent reports show that properly prepared polyvalent serum has given more satisfaction. Bumm [35] reviews his results in 32 cases of severe infection, and in four particularly striking cases of high fever, but without phagocytosis. Hyperleukocytosis occurred 12 hours after the injection of the serum and was intense, the leukocytes incorporating the steptococci with great avidity. Rau [36] has reported similar good results, and a reduction of his mortality from 60 to 36 per cent. in streptococcus infection. Escherich [37] has also reported beneficial effects in scarlet fever with the Moser polyvalent serum. Anti-streptococcus serum is, however, more of a prophylactic measure against peritonitis and it is doubtful

whether it has much effect after the infection has passed the confines of the uterus. It should, however, be used.

Other substances, however, are used to enhance the resistance of the peritoneum and to increase the activity of the leukocytes. Mickulicz [38] used intra-peritoneal injections of nucleic acid and performed operations as soon as the leukocytes began to increase. In 45 cases, the increase varied from 9 per cent. to 452 per cent. Seven cases died, but none from peritonitis, although two recovered in spite of this complication. Diez [39] also used nucleic acid and advocates the injection of a 2 per cent. solution as a preliminary to operation.

Hanner [40] reports 51 cases in which 50 c.c. of the same acid was injected in the form of sodium nucleate 13 hours before operation. Marked hyper-leukocytosis was present in every case. The reaction was always striking, the temperature rising one to two degrees C., with a chill in some instances. He also, as did Gray,[41] used quantities of dead organisms as vaccine, but the effect was doubtful.

It would, therefore, seem that the injection of nucleic acid is a useful adjunct to early operation in generalized peritoneal infection, particularly in infection from the streptococcus.

Operation should remove, if possible, any focus of infection with as little traumatism and handling of the intestines as possible. Lavage should not be performed, as the risk of spreading the infection is too great. The treatment should be after the method of Murphy and consist of making a small opening with the introduction of drainage tubes. Vaginal drainage is often useful. Evacuation of the intestinal contents in cases with paralyzed intestinal walls is sometimes of use. A high rectal tube may answer when the sigmoid is involved. If paralysis be higher than this, enterostomy is necessary.

Peritonitis characterized by abundant sero-purulent exudate and unaccompanied by signs of deep inflammation is a comparatively benign affection provided that operation is timely; but that form characterized by little or no exudate and with the gut wall red, dry, distended and paralyzed, gives an almost hopeless prognosis.

The prognosis, as a whole, in puerperal peritonitis is bad unless early operation is done. However, results are improving, as is shown by 121 cases collected by Jeannin.[42] These histories extend back to the early days of abdominal surgery, yet there were 60 recoveries and 61 deaths. This showing will be improved with more modern methods of treatment and earlier operation. In cases of puerperal general peritonitis treated expectantly, the result is almost invariably fatal, while in those cases treated surgically there are frequent successes, hence every case of puerperal general peritonitis should be operated upon as soon as diagnosed.

In the after-prognosis of such severe puerperal infections, it should be kept in mind that the late appearance of metastatic abscesses is not an uncommon condition.

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SUBACUTE PERFORATION OF THE STOMACH AND DUODENUM.

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THE condition of "subacute" perforation of an ulcer in the stomach or in the duodenum is one which has received less attention than it merits. It is not infrequent, it is of great interest, and its discrimination from "acute" perforation is of no little importance from the therapeutic standpoint. Since attention was first called to it, only one paper, so far as I am aware, has dealt specially with it; this paper was written, with characteristic ability, by Dr. F. B. Lund, of Boston (*Boston Med. and Surg. Journ.*, 1905, vol. i, p. 516).

I find that in all, I have operated upon 15 cases, 5 of which were dealt with in the early stage, 10 after the lapse of months or years; in 4 an hour-glass stomach was found.

In subacute perforation of the stomach there is a sudden rupture of an ulcer, an ulcer which, without exception in my experience is of the "chronic" type. The chronic ulcer with its deep excavation, its deep edge, and its surrounding induration has eroded the walls of the stomach little by little, until finally and abruptly the thin barrier between it and the peritoneal cavity is broken through. The conditions are, up to this point and in these particulars, in no way different from those existing in "acute" perforation. But whereas in the latter form the rupture is of fair size and at once allows the contents of the stomach to spread themselves freely over the general peritoneal cavity, and to cause there a universal infection (though the path followed is often recognizable, and can not seldom be predicted), in subacute perforation there is, by one agency or another, a definite localization of the fluids escaping from the stomach, and in many instances a narrow circumscription of the peritoneal response to their invasion.

It becomes, therefore, a matter of interest to know the circumstances under which this limitation is affected. I have seen examples of the following:

(1) An empty condition of the stomach. In "acute" perforation the stomach is often full; the rupture of the ulcer, it is frequently remarked, occurs soon after a meal. If the stomach be empty, say 5 or 6 hours after a meal, perforation may still occur, but there is, of course, little or no escape of contents.

In such circumstances, the ulcer may be ruptured by a violent strain, a sudden movement, or a severe shake. It is not long before a most vigorous defence is made by the peritoneum, lymph is thrown out copiously in flakes, and a thin serous fluid begins to fill the peritoneal cavity. The escaping contents of the stomach being small in quantity and feeble in bacterial activity, are rapidly circumscribed.

(2) The plugging of the opening in the ulcer with a tag of omentum. Of this, I have seen one perfect example. The ulcer was close to the pylorus, its opening small; into this opening there fitted, as accurately as any cork, the bulbous end of a thin omental tag which came upwards from the greater curvature of the stomach. There was not any adhesion of the stomach to the abdominal wall, or to the overhanging liver; nor was there need for any, for a more perfect plugging of an opening could not be conceived. The little omental tag seemed quite to have grown into the opening which it so securely closed.

(3) The opening may be sealed over by layers of plastic lymph. When the abdomen is opened, a clear or slightly turbid fluid is found, but no ulcer is apparent. At some part of the stomach wall a thick adherent mass of plastic lymph will be seen, as thick as wash-leather, and in appearance very similar. On peeling this off, a small perforation is found, from which a bubble may be squeezed. This condition may be a later stage of that already referred to (No. 1), but it is equally possible that as the ulcer deepens, the peritoneum is irritated, and protectively deposits layer after layer of lymph upon the outer

side of the base of the ulcer, so that when the final dissolution of the stomach wall occurs there is already a barrier almost or entirely impenetrable, to check the escape of the stomach contents.

(4) The stomach becomes adherent at the base of the ulcer. The adhesion may be to the anterior abdominal wall, to the under surface of the liver, or to the pancreas. Other points of adhesion are recorded, but they are unusual and I have not met with them.

The adhesion to the anterior abdominal wall is the most frequent, as would be expected from the usual position of perforating ulcers in the stomach. It is possible that adhesion of the ulcer is only a later stage of No. 3, the plastic lymph becoming welded on its outer side to an adjacent firm structure, and that as the ulcer deepens, the lymph is digested until the actual base of the ulcer is formed by the muscles of the abdominal wall, by the pancreas, or by the liver.

At the place in the abdominal wall where this adhesion occurs, a tender and resistant area can readily be distinguished, and a diagnosis of the condition made with confidence. In one patient whose ulcer had perforated "subacutely" years before, the base of the ulcer was formed by the posterior sheath of the rectus, and a hard mass had formed at this point. A diagnosis of malignant growth had, not unnaturally, been made. (See Case XV).

SYMPTOMS.

In every particular save one, that is intensity, the symptoms are the same in subacute as in acute perforation. There is a sudden onset of pain, severe, and almost intolerable, but measurably less than in acute perforation. The pain comes almost without exception in those who have suffered for years or months from the usual symptoms of gastric ulceration. There are some cases in which there has been a notable exacerbation of pain in the days preceding the rupture, and patients have explained to me that the body or side felt stiff, and sore, that laughing or stretching, as in reaching up to a high shelf

caused great discomfort. (See Case II.) These inaugural symptoms of perforation are important, and if the practitioner chances to hear of them from a patient whom he knows to have an ulcer in the stomach, he should accept them as undoubted evidence of impending perforation. In my own experience perforation of an ulcer has never occurred without a previous history of gastric ulcer being given. The pain is sudden in onset, and may be followed rapidly by vomiting, prostration and possibly (though rarely) by collapse. The abdomen on examination is everywhere tender. A careful examination may reveal an especially tender and resistant area. A patch 2 or 3 inches in diameter may be excessively sensitive, and on palpation it may seem as though a flat hard disc had been inserted in the abdominal wall.

The symptoms abate slowly. The pulse does not increase, its character improves, vomiting ceases; the abdomen which was hard and retracted at the first, may become supple except at the one spot, or it may be a little distended, and free fluid may possibly be recognized. The patient's condition may indeed, at this stage, be so satisfactory, as compared with the initial condition, that the diagnosis may be in doubt. If indeed morphine has been given, as it still very often is, in repeated doses, the aspect of the patient may be little different from the normal. If no operation is practised at this time, there are three directions which affairs may take; either a perigastric abscess may form, or a secondary rupture into the general peritoneum may occur, or the adhesion of the ulcer to the abdominal wall or liver or pancreas may become firmer, the acute inflammatory conditions subside, and the patient live for years with a chronic ulcer whose base is formed by one of the structures already mentioned. Of the three I believe the last to be the most common.

DIFFERENTIAL DIAGNOSIS.

The conditions likely to be confused with subacute perforation of the stomach or duodenum are few. The chief difficulty in diagnosis arises in discriminating a subacute perfora-

tion near the pylorus, from a condition of cholecystitis. In both, there are pain, sudden in onset, severe, possibly colicky; in neither is there any general invasion of the peritoneum; in both a localized peritonitis with a tender resistant area is recognized. The previous history may afford a clue, but is not likely to do so. Lund, in the paper already mentioned, gives notes of a case in which it was considered possible that a perforation of a malignant growth in the colon had occurred.

In one case of subacute pancreatitis which went on to the formation of an abscess, from which I removed a large slough of the pancreas, I had diagnosed a posterior subacute perforation of the stomach followed by subphrenic abscess. This mistake is one which, from clinical signs alone it would be difficult to avoid.

In my own cases a correct diagnosis was made without difficulty in almost every case.

TREATMENT.

If the patient is seen at the time of the onset of perforation, I think there can be no hesitation in advising instant operation. In the first place accurate and unequivocal discrimination between acute and subacute perforation cannot be made, and by delay valuable time may be lost. Moreover, though it is true that many of the subacute cases, with rest in bed, abstention from food and so forth, may progress to the chronic stage, there are indubitably other possibilities, which, when reckoned with, make early operative treatment the safe and prudent course. In all the cases I have seen in the early stage, save one, I have operated and have cleared the ulcer of adhesions, infolded it, and occasionally sutured a flap of omentum over the line of stitches. I did this at first because I did not distinguish between the acute and the subacute cases; I did it subsequently because it had seemed to be the right course to have pursued in the early cases. Dr. Lund has, however, suggested that since the perforation is already sealed off, there is no need to expose and then close the rent afresh, and that, accordingly, the proper course is to perform gastro-enteros-

tomy forthwith, leaving, if possible, the ulcer and its secure barriers untouched. He writes:

The treatment of an open perforation is manifestly to invert the edges of the ulcer and close it by suture. The ulcer has already perforated into the general cavity and the peritoneum is soiled. In these subacute perforations, however, nature has already closed the perforation, and if we can get along without tearing the adhesions, opening up the ulcer and soiling healthy peritoneum, we give our patient a distinctly better chance. In case the ulcer is on the anterior surface or lesser curvature and is to the right of the median line, and the adhesions are to the inferior surface of the liver, there is nothing to prevent our turning up the posterior surface of the stomach and performing a posterior gastro-enterostomy without breaking up the adhesions, opening the ulcer, or soiling the cavity with stomach contents. We provide internal instead of external drainage for the ulcer, and we operate in a region where the peritoneum and gastric wall are healthy instead of inflamed, and where our opportunity of getting perfect healing is the best. And last, but not least, we give the best treatment to the underlying condition of chronic ulcer to which the perforation has been due.

This I believe in some cases, more especially those in which the pyloric part of the stomach or the duodenum are involved, will prove to be the best practice. In other cases, however, in those for example where the ulcer is on the anterior wall of the body of the organ, and a wide area is covered with lymph, and adherent, I think that the exposure and suture of the perforation, followed or not by gastro-enterostomy will be the proper course to adopt.

In those cases where years have elapsed since the initial catastrophe, a separation of the ulcer from its adhesions is certainly unnecessary, and is probably most undesirable. For these, gastro-enterostomy is the operation to be advised if the pyloric part of the stomach is involved. If the cardiac end of the lesser curvature is involved, gastro-enterostomy is here also desirable, but a separation of the ulcer, if readily performed, is also good practice.

In four cases I have found an hour-glass stomach, the ulcer at the isthmus of the organ being firmly fused to the anterior abdominal wall. On separating the stomach an opening was found in its walls, and it at once became clear, that the base of the ulcer had actually been formed by the abdominal wall itself.

The following are the notes of all the cases upon which I have operated. They may be divided into three classes. In the first, Cases I to XI, the operation was performed when the perforation was recent. In the second, Cases VII to XI, when the perforation was of old standing. In the third, Cases XII to XV, when an hour-glass stomach was present.

CLASS I. RECENT SUBACUTE PERFORATION.

CASE I.—*Recent Subacute Perforation of an Ulcer on the Anterior Wall of the Stomach.* A female patient, aged 24, seen March 13, 1902. Had been married 8 weeks previously. Before that she had suffered slightly from indigestion, but never severely. Thirty-six hours before operation she was suddenly seized before breakfast with acute pain beneath the left costal margin. There was no vomiting (the stomach probably being empty, after a night in bed, the last meal being supper the night before); faintness and collapse were present. The abdomen which was generally tender became gradually distended and on examination was thought to contain free fluid. In the upper left quadrant of the abdomen, beneath the outer part of the rectus, was an area which was very acutely tender.

When the abdomen was opened through the left rectus muscle a thick localized deposit of yellow plastic lymph was found over an area about 2 to 3 inches in diameter. On peeling this off, a small perforation, almost pin-point in size, was seen; it was in the middle of a hard and indurated area the size of a shilling. When sutures were passed to infold the ulcer they cut through at once; so that a fairly large area had to be infolded by sutures that were not tightly drawn. Over the suture line, a broad flap of omentum was turned and fixed by two stitches. There was a fair quantity of perfectly clear, slightly yellow inodorous fluid in the abdomen. The abdomen was closed. Re-

covery was satisfactory. In July, 1905, the patient was quite well, and had borne two children.

CASE II.—*Recent Subacute Perforation of the Stomach.* The patient, a girl aged 18 years, was seen November 8, 1902. For the last few weeks she had had some slight pain after food just beneath the left costal arch. The pain had been worse when she laughed and when she stretched her left arm upwards. There was a sudden onset of symptoms about 8 P.M. on November 7—pain, collapse, shallow breathing, etc. The abdomen was intensely rigid and immobile. The perforation was about equal in size to a lead-pencil and was situated near the lesser curvature towards the cardia. There were many flaky adhesions covering the perforation completely and sealing it off. A little clear fluid in the peritoneal cavity. The ulcer was sutured and an omental flap was turned over it. There was no drainage. The patient recovered. Reported to be quite well in June, 1905. In domestic service.

CASE III.—*Recent Subacute Perforation, Followed by a Second, Separate Acute Perforation of the Stomach.* A woman, aged 23 years, was seen March 5, 1903. She had had indigestion for several months. On March 1, when in London, she had a sudden attack of pain beneath the left costal margin; she felt faint and prostrate, and vomited. She gradually felt better and on the 3rd traveled from London to Bawtry and ate a good luncheon on the journey. The side then felt "stiff" and hurt her if she laughed or turned quickly. On the 4th after breakfasting she had a sudden extremely severe pain, with collapse and vomiting. The abdomen had gradually distended and was now blown out and tympanitic; a fluid wave was easily felt. The patient looked very ill. The pulse was 156. Two perforated ulcers were found, both on the anterior surface and in the cardiac half of the stomach near the lesser curvature. They were distant about one and a half inches from each other. One opening was of the diameter of a lead-pencil and the other of a knitting needle. From both, fluid gushed out. Both were closed by suture and the stomach was folded over. The omental lid afterwards covered both in. Drainage was effected by a split tube and a gauze wick at the upper part of the incision and through a separate suprapubic incision. Recovery ensued. Gastro-enterostomy subsequently performed. Quite well in 1905.

CASE IV.—*Recent Subacute Perforation of the Duodenum. Enormous Deposit of Plastic Lymph.* The patient was a girl, aged 17, who had suffered for twelve months from indigestion, and for years from anæmia. Four days before I saw her she had a very severe attack of pain in the right side and across the abdomen, vomiting and faintness. When the abdomen was opened there was a little clear fluid and around the duodenum a very thick tenacious plastering of all the parts with lymph. This was wiped away with rough gauze, the process requiring time and patience. Eventually a minute duodenal perforation was found about 1 inch beyond the pylorus. The ulcer was infolded, and the abdomen drained in front and behind. The patient recovered, and was reported well in March, 1906.

CASE V.—*Recent Subacute Perforation of Duodenum.* A man, aged 22, was seen May 11, 1904. He had been quite healthy up to beginning of April, 1904, when he felt a slight pain in the abdomen. This only lasted a few minutes and then passed off. Three weeks later he was seized with extremely acute abdominal pain. Within three minutes he was in a state of complete collapse. The pain was most severe in the epigastric region at first; later it was most acute in the lower part, and in two or three days it settled in the right iliac region. He vomited at the beginning, not again later. There was slight constipation. He recovered very rapidly. He went out for a stroll on the ninth day. Incision made over appendix. Appendix found lying along outer side of ascending colon and adherent in all its length. It was removed. The hand passed up into the liver region, felt numerous adhesions. A second incision was made over the gall-bladder. Numerous recent adhesions of the gall-bladder to liver and duodenum were separated, also a very strong one between the duodenum and under-surface of the liver. On examining the surface of the duodenum thus bared, a minute perforation was seen. This was occluded by Lembert sutures and abdomen closed. The patient recovered. In June, 1905, reported to be quite well.

CASE VI.—*Recent Subacute Perforation.* March 24, 1904, female, aged 25. Indigestion twelve years. For many years she had had acid eructations, and for the last two years has vomited after food. She has had many severe attacks of pain in the epigastrium. Four days before admission and again one day before she had attacks of pain and vomiting, but not any more

acute than many she had had before. During the last three years her weight has dropped from 9 st. to 5 st. 8¾ lbs. At the operation, perforation, the size of a small pea, was found in the upper part of the first portion of the duodenum. The ulcer was about the size of a half-crown. There was severe local plastic peritonitis, but no general infection. The perforation was closed by Lembert's sutures, and a posterior gastro-enterostomy performed. The patient recovered. She was sent by Dr. Rowling. Report received from Dr. Rowling June 26, 1905: "Gained 2½ st. in weight during the three months succeeding the operation."

CLASS II. OLD SUBACUTE PERFORATION

CASE VII.—*Old Subacute Perforation.* June 4, 1902; female, aged 27. Five years ago had an acute attack of abdominal pain, vomiting, etc. Was in bed 22 weeks. The doctor who saw her and the consultant, diagnosed "perforating" ulcer of the stomach. Constant indigestion, pain, and vomiting since then; can never take solid food, and ordinary liquid diet causes pain and uneasiness. Vomits every three or four days now. Stomach moderately dilated. At the operation, very dense and numerous adhesions were found on the posterior surface of the stomach, especially thick and tough near the pylorus, where the stomach was almost fused to the pancreas. A fairly large stomach. Posterior gastro-enterostomy. The patient recovered. The patient was seen with Dr. Millhouse and Dr. Anning. Since the operation the patient has had three serious attacks of her old trouble, apparently, each one less severe than the preceding one. Since August, 1904, she has had no symptoms of a return, and to all appearances the cure is complete. Her appetite is good, and she eats the food usually going in the house without any ill effects. Weight at the time of operation, 6 st. 6 lbs., and on July 6, 1905, 8 st. 1 lb.

CASE VIII.—*Old Perforation, Probably Subacute.* September 16, 1902, female, aged 37. Has had indigestion for "many years." Eighteen months ago she had "perforated gastric ulcer" of the subacute type, diagnosed by Dr. Bishop. Since then her stomach symptoms have been intolerable. Pain constant and gravely increased by food of any kind; vomiting at least every other day, fermentation and eructation of obnoxious gas. She has vomited frequently half a chamber-utensil full of

sour semi-digested food. She has "lost a lot of flesh." The stomach is very large, obviously standing out on her thin abdomen. The washing out required 49 pints before the fluid returned clear. Free HCl. At the operation, the stomach was found buried in adhesions to both anterior and posterior surfaces. The whole outline of the stomach was warped. The posterior surface was exposed with some little difficulty owing to adhesions to transverse mesocolon and to the pancreas. It was probably here that the perforation had occurred. Posterior gastro-enterostomy was done. I was dissatisfied with the way in which the anastomosis seemed to "sit" after returning within abdomen. Reflux vomiting occurred; 132 ounces of deeply bile-stained fluid were vomited in two days. I, therefore, reopened the abdomen and performed an enteroanastomosis between the afferent and efferent limits of the anastomosing loop. The patient recovered. The patient was sent to Dr. R. W. S. Bishop, Kirkby Malzeard. She gained 9 lbs. in weight. She often remarked: "I'm surprised at myself eating so much." Report received from Dr. Bishop, June 28, 1905: "I saw Miss B. last night and send you following particulars of her present condition. General condition excellent, far better than for several years before she had perforation, strong, able to walk with ease to and from Ripon—five miles, both ways ten miles—and even farther. No anæmia, well nourished and in good spirits, apparently in perfect health. No gastric pain or discomfort, no nausea, vomiting or flatulence—"body much smaller than before operation"—no attacks of distension as before. Bowels more or less regular, and kept all right by aid of brown bread and similar rough food. Able to eat everything. This year has eaten more salads than for many years past. Had one attack of indigestion in two years, not of long duration; generally careful not to eat most indigestible foods.

Case IX.—*Old Subacute Perforation; Adhesion to Pancreas.* September 25, 1902, female, aged 60. Has been failing in health for 9 to 10 months. The chief symptom has been vomiting. At the onset a sudden seizure of vomiting, very acute and lasting over 24 hours. There has been a series of attacks of vomiting. Pain is noticed about an hour before a meal is due, and lasts from a few minutes to two or three hours; is never very severe. She has lost flesh and has got weaker, occasionally having to spend a part of the day in bed. No melæna. No hæma-

temesis. A small, hard tumor felt above and to the right of the umbilicus, a little movable. On distension with CO_2, an enormous stomach, reaching a full hand's breadth below the umbilicus. At the operation a very large stomach was found. On the posterior surface of the stomach one large ulcer with several thick adhesions around it. In the second portion of the duodenum the tumor was found. It was a mass about the size of a large walnut, adherent to the pancreas, with which it seems inseparably connected. The duodenum above this point looks distended. Probably chronic duodenal ulcer with interstitial pancreatitis. The patient recovered. The patient was sent by Dr. Welch, Staningley. In Jan., 1903, she was eating heartily, and was free from all discomforts. Report received from Dr. Welch, June 21, 1905: "I saw Mrs. B. to-day. She tells me that she has enjoyed excellent health since the operation, and has had no stomach trouble of any sort. She certainly looks very well, and she does all the housework at her own home."

CASE X.—*Old Subacute Perforation; Adhesion to Pancreas.* December 14, 1904; female, aged 50. Perforation of an ulcer occurred 9 months ago (probably). There was acute peritonitis of sudden onset, intense epigastric pain, collapse, vomiting, etc. For more than a month she was extremely ill. The general peritoneal involvement subsided, and epigastric fulness, tenderness and rigidity remained. Since then has had constant pain after food, often intense, vomiting, inability to take solid food, and marked wasting. At the operation, an ulcer about junction of middle and pyloric third, absolutely welded to the pancreas. Gastro-enterostomy on proximal side. The patient recovered. She was sent by Dr. Bertram Watson. Report received from Dr. Bertram Watson, June 21, 1905: "Mrs. T. is in good health. The operation completely relieved her stomach symptoms, which, you will remember, were of 14 months' duration. I do not know what increase of weight there has been, but she tells me that she can eat anything now with impunity."

CASE XI.—*Old Subacute Perforation; Adhesion to Abdominal Wall.* January 7, 1905; female, aged 45. In May, 1904, an acute attack of abdominal pain, and vomiting, followed by distension. It was thought that there might be a rotation of an ovarian cyst, but the acute illness subsided in a few days. Since May, 1904, has suffered much from pain after food, vomiting,

etc., and has lost weight. Since her confinement, six months ago, has noticed a swelling at the lower part of the abdomen. On examination now, a hard lump, just to the right of the middle line, adherent to abdominal wall. In lower part of abdomen an ovarian cyst, equal in size to a six months' pregnancy. At the operation, incision made between umbilicus and pubes; a large ovarian cyst springing from the right side. Much glairy fluid in the peritoneum. No twist of pedicle. An examination of the stomach showed a hard mass at pylorus, which was adherent to abdominal wall. Probably a "subacute" perforation of a gastric ulcer. Posterior gastro-enterostomy. The patient recovered. She was sent by Dr. Macaulay, Halifax. She was reported well in 1906.

CLASS III. SUBACUTE PERFORATION. HOUR-GLASS STOMACH.

CASE XII.—August, 1899; female, aged 39. Ten years ago the patient had an illness characterized by profound anæmia. Seven months ago there were clear symptoms of ulcer of the stomach, but neither then nor at any time any acute illness suggestive of perforation. Now vomits after all ordinary food and more often than not, even after small quantities of fluid food. Pain after food was exceedingly severe. On examination of abdomen a dilated stomach could be felt. At one point, a little to the left of the middle line, and slightly below the ensiform cartilage, was an area 2 inches in diameter which was markedly tender, and offered increased resistance on palpation. This area was found at the operation to correspond precisely with the area of stomach adhesion. The patient had lost weight and deteriorated seriously in general health during the last few months. At the operation an hour-glass stomach was found. The narrow constriction was near the middle of the stomach, and adherent to the anterior abdominal wall over an area equal to a crown piece. On each side of this the stomach dilated and seemed to be anchored by the adhesion. On separating the stomach from the abdominal wall an opening into the viscus was exposed and the stomach contents escaped. The opening was enlarged transversely and the wound and fistula were stitched up vertically. An omental graft was brought to cover in the sutured area in order to guard against future anchoring. The

patient recovered. For a month after the operation there was pain at times and loss of appetite. Since then she has been free from pain and in excellent health. Appetite and digestion are good. The patient was seen with Dr. Bailey, Horsforth. In Feb., 1902, her condition was still perfectly satisfactory. In Oct., 1903, the patient was reported to be in perfectly good health —"in excellent condition." In July, 1905, in sound health. "A complete cure."

CASE XIII.—April 6, 1901; male, aged 46. Symptoms for 12 months; pain, heaviness, discomfort after meals; loss of weight and general deterioration in health. At Christmas had a sudden attack of acute pain and hæmatemesis, and was very ill for several days; since then has never taken any food (solid or liquid) without pain. Has noticed on several occasions that the stools were "black as ink." Vomits now every day. At the operation 2 ulcers were found near the pylorus, one on gastric, one on duodenal side. A mass equal in size to a walnut was found at the pylorus. Pylorus was very narrow, adherent to liver, and gall-bladder by dense bands. At the middle of a hugely dilated stomach was a constriction that would admit 4 fingers. Posterior gastro-enterostomy to pyloric pouch. At the necropsy 2 ulcers (duodenal and gastric) were found, the former very adherent to the gall-bladder; the latter had perforated into a mass of adhesions, its base being partly formed by the pancreas. The patient died. The patient was sent by Dr. Crawford Watson, Harrogate. All went well for 3 days; then a large prolapse of rectum (from which he had previously suffered) came down during the night, and was not discovered for 4 hours. When I saw him the prolapse was livid and œdematous, and could not be reduced until ether had been administered. From this time patient became gradually worse; the temperature ran up to 104 and 105, and he died 4 days later. The following is an abstract from the necropsy record, written by Dr. Maxwell Telling: "The stitches are quite sound, the opening good, and surgical technique perfect. No peritonitis. The hæmorrhoidal, and inferior mesenteric veins are full of disintegrating clot (septicæmia)."

CASE XIV.—January 14, 1904; female, aged 35. First attack October, 1901; acute sudden pain, faintness and collapse. In bed for a fortnight then; the chief physical signs being exquisite local tenderness and fulness in the epigastrium. Ever

since has had pain about one hour after food, relieved by vomiting. No hæmatemesis. She recovered April, 1902, and then kept well up to December, 1903. She then had pain and flatulent distension about an hour after meals, with regurgitation of highly acid fluid. On January 13, 1904, about one and a half hours after a light meal and while sleeping in a chair, she was seized with sudden violent pain and became collapsed. I saw her about 1.30 P.M., January 14,—*i.e.*, about 18 hours after the onset of acute symptoms. On opening the abdomen the stomach was found to be adherent by recent lymph to the under surface of the liver. On separating the adhesion, a small perforation was found. It was closed by two layers of Lembert's sutures. It was now noticed that the puckering of the chronic ulcer had caused a narrowing of the stomach at about its middle. Gastroplasty was performed. The patient recovered. In March, 1905, was in perfect health, had gained weight and was eating well. Seen with Dr. Baskett, Halton.

CASE XV.—February 8, 1904; female, aged 42. Sudden onset December, 1900, while lifting a heavy weight. She had had pain and vomiting almost every day since. In July, 1901, a tumor was noticed in the abdomen; this tumor has not increased in size. She has once vomited bright blood. She is fearfully emaciated; her weight has gone down from 8 st. 9 lbs. to 5 st. 7 lbs. There is a painful tumor to the left of the umbilicus. The veins of the anterior abdominal wall are much distended. Incision made over tumor. This was found to be a large inflammatory swelling formed by the base of a large ulcer of the stomach adherent to the anterior abdominal wall. The ulcer was at the junction of two pouches. The ulcer was cut away and the stomach closed. The condition of the patient was so bad as not to allow time for a gastro-enterostomy. The patient recovered. Her doctor reports early in 1905: "Gained 2 st.; eats anything and does her own housework." In July, 1905, symptoms were beginning again, and it seemed not unlikely that gastro-enterostomy will be necessary. In August, 1905, gastro-enterostomy was performed; the patient recovered, and is now (March, 1906) in good health.

REPORT OF A CASE IN WHICH A LARGE NUMBER OF FOREIGN BODIES WERE REMOVED FROM THE STOMACH.*

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THE literature is quite full of cases operated upon for the removal of foreign bodies from the stomach, but as a rule these individuals seek the advice of a surgeon only when the suffering becomes intolerable. A great many foreign substances have been removed at post-mortem from the stomach.

When the stomach is not dilated or ulcerated, and when the pylorus is patulous, gastrotomy is sufficient, with the removal of the foreign bodies. A gastro-enterostomy is occasionally demanded on account of the obstruction at the pylorus. The case I have to report is as follows:

Mr. E. W., aged 47, American, 4 feet 11 inches tall, weighs 140 pounds. His occupation is that of glass and nail eater. Has eaten glass for 20 years and it never troubled him until February, 1906. Has swallowed 8- and 10-penny nails and horseshoe nails for the last five years; a few were passed in stools. Has swallowed pieces of glass as large as his thumb. Mouth has been cut several times, anus cut once. Stools have been black only during the last five or eight months. Drinks a gallon of water at a time in one minute. Has drunk 40 gallons of water in a day. Four years ago had a hæmorrhage from stomach after drinking 12 gallons; bled about one pint. Is a contortionist, eats fire and is a strong man. His last attack came on while in St. Louis, five weeks ago. He was on the street when he was taken suddenly with severe pain across stomach and in region of heart. Was taken to hospital in St. Louis and remained there three weeks until he came here, two weeks ago. Was fairly

* Read before a joint meeting of the Crow River Valley and Meeker Co. Medical Societies, at Litchfield, Minn., Oct. 10, 1906.

well until two days ago when he was taken again and laid up in bed for a couple of days.

Patient vomits considerable matter of a black color, which tastes like iron rust. Stools are of a black color. Has a feeling of weight in his stomach. Has lost about 25 pounds in weight in the last five months. Has not lost strength at all, but is short-winded. It hurts him to breath, especially to do deep breathing, which produces the sensation of a knife cutting in his stomach. There is a constant steady pain which becomes worse at times. Says that he can feel objects in his stomach at times.

Habits.—Uses tobacco moderately, has been an inveterate drinker until eight months ago, since which time he has drank no alcoholics. Appetite and sleep good. Bowels are constipated. Patient is well nourished, muscular; bends with his teeth an iron rod ¾ inches in diameter. Straightens out horseshoes, breaks rocks with his fist. Tongue not coated or scarred, of good size. Upper lip shows scar to right of median line. Eyes normal. Two fingers are gone from left hand.

Family History.—Father died at 65 years of stone in bladder. Mother died at 75 of cancer of stomach. Two brothers well, two dead,—one of blood poisoning at 49 years, one of consumption and Bright's disease at 39 years.

Previous and Present History.—Married. Has had 8 children, of whom 2 were still born and 4 died in infancy. Two are living and well. Patient was kicked in head by horse 22 years ago, receiving only scalp wound. Was in hospital 5 years ago and had first 2 fingers of left hand amputated. Was also in hospital three months ago for stomach trouble. At that time stomach was washed out but no foreign matter obtained.

Condition on Admission.—Teeth in good condition—very short. Mouth and pharynx negative. Cannot take a deep breath. Stomach dilated two fingerbreadths below umbilicus—very tender. Temperature between 97.5° and 99.5°; pulse between 98 and 100. Chief symptoms: Pain, vomiting, black stools, loss of weight, feeling of foreign body in stomach.

Urine: Normal except a few pus cells. Blood: June 11, 1906, 3 P.M., hæm., 90 per cent.; R. B. C., 4,600,000; W. B. C., 10,200.

Operation, June 13, 1906. General condition of patient: Good before operation. Ether. Pulse before operation 90;

pulse after, 100. Operation commenced 9.05 A.M., completed at 10.30 A.M.

Description of Operation.—Vertical median incision—stomach greatly dilated. Induration found at pyloric end. The stomach wall was greatly thickened in places, in others showing scars of healed ulcers. The wall was generally very friable and with difficulty held the sutures. Posterior gastro-enterostomy. Two rows of Pagenstecher thread and one row of catgut; Lembert sutures. Irrigation of stomach. Dry dressings, cigarette at top of incision. Fifty-two nails were removed through the opening made. (Fig. 1.) Some of them were as small as shingle nails, but most of them 6- 8- 10- and 20-penny nails removed from sacculated cardiac end of stomach. These were in various stages of erosion, two being like darning needles. Also 5 pieces of thin glass removed.

The nails were in bunches and a number of them imbedded in the stomach wall and surrounded with exudate, making their removal more difficult and accompanied by some hæmorrhage. The extra suture row was used to prevent a leak, owing to the possibility of some of the sutures cutting through the friable wall.

This case was of especial interest because of the particularly bad condition of the stomach, viz.: the ulcerated areas; the thickened walls which were hypertrophied and fibrous in places where old ulcers had healed; because of the friability of the stomach wall along the greater curvature, and, especially, because of the obstruction of the pylorus and the large size of the organ.

This patient did not vomit after the operation. He made a rapid convalescence, and on the fifth day insisted on eating solid food. On the seventh day he was out of bed, as he declared himself well. On the ninth day he could not be persuaded to stay in the hospital longer and went home. The following day he was around town looking for a job, and on the twelfth day he called at my office demanding the nails, as he stated he had a chance to make $5.00 that evening by exhibiting the same, and was only persuaded to leave without them by the loan of a dollar, to pay board, as he said. He stated since leaving the hospital he was eating regular food and felt

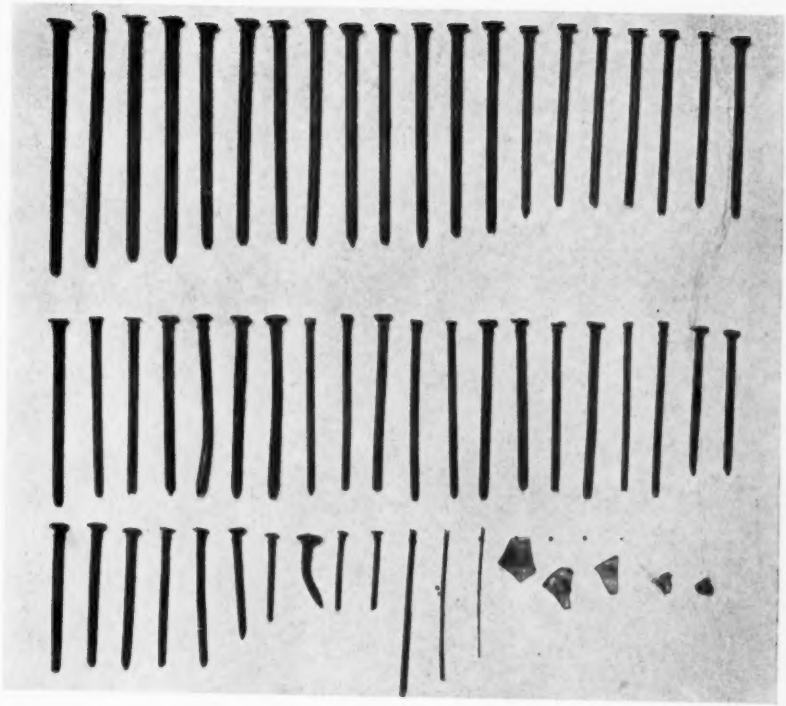

FIG. 1.—Foreign bodies removed from stomach.

well. Four days later, while in a neighboring city, he was seized with severe pains in the stomach. He was taken to a hospital and kept quiet for a few days when he was out again.

He has since called at my office stating that he had suffered occasionally but was comparatively well.

SARCOMA OF THE SMALL INTESTINE AND MESENTERY.

REPORT OF A CASE IN WHICH SIX FEET AND FIVE INCHES OF THE SMALL INTESTINE WERE REMOVED, WITH RECOVERY.

BY GILBERT BARLING, M.B., F.R.C.S.,

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Professor of Surgery in the University of Birmingham, Surgeon to the General Hospital; Consulting Surgeon to the Nuneaton Hospital.

On May 22, 1906, I was asked by Dr. Joseph to see with him at the Nuneaton Hospital, a boy aged six years, who was admitted on May 19 with abdominal pain and sickness, associated with a temperature of about 100°. Six weeks previous to the child's admission he had also suffered a similar attack with diarrhœa, and a month before admission the abdomen was noticed to be enlarged.

As soon as the child was admitted to the hospital the symptoms subsided, until May 22, when he again began to vomit after the administration of an aperient, but the bowels acted with the assistance of an enema given some hours after the administration of liquorice powder. When I saw the child he looked ill, his temperature was about 100° and his pulse also, he had a tumor larger than one's two fists occupying the central parts of the pelvis and the lower abdomen, reaching well above the umbilicus; it was movable laterally and vertically, was firm in consistence and free from tenderness. The position of the swelling, its mobility and the history of the pain, sickness, and, on one occasion, diarrhœa, suggested to me that the tumor was one of the great omentum dragging upon the colon, and the mobility was so free that I determined to attempt the removal of the growth.

The abdomen was opened slightly to the left of the middle line, when it was found that the surface of the growth was covered by, and seemed to be intimately blended with, the great omentum, the very large vessels of which ramified over the sur-

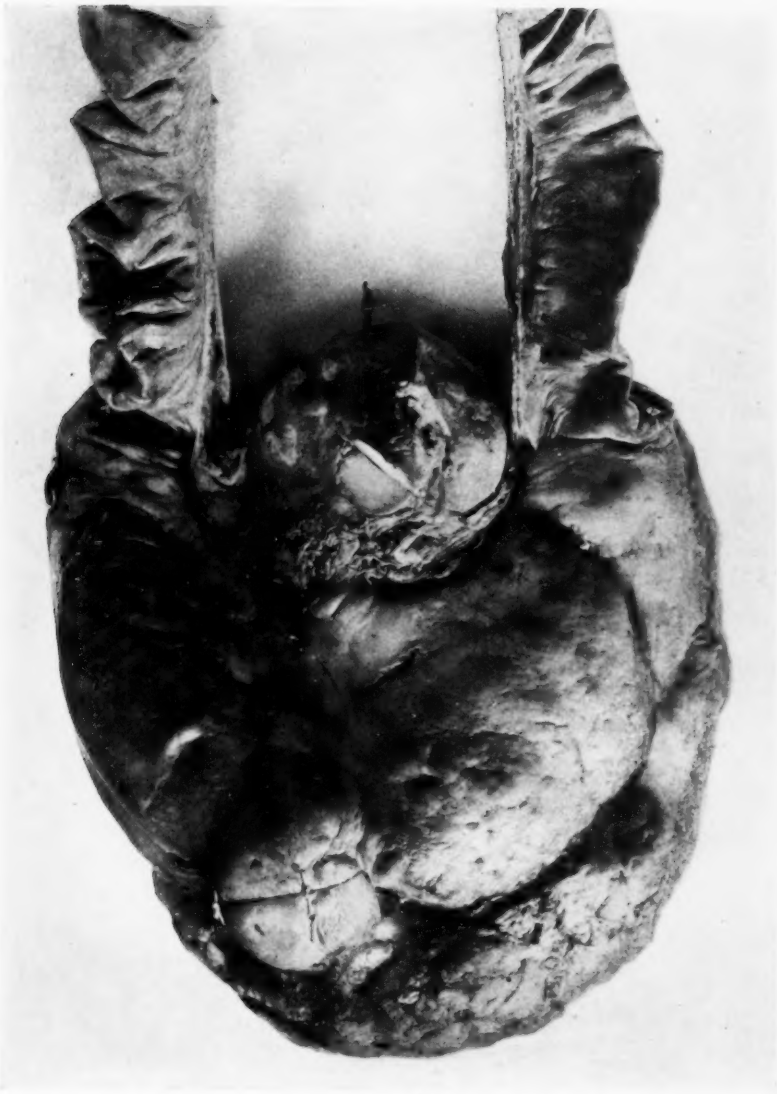

FIG. 1.—Sarcoma of small intestine.

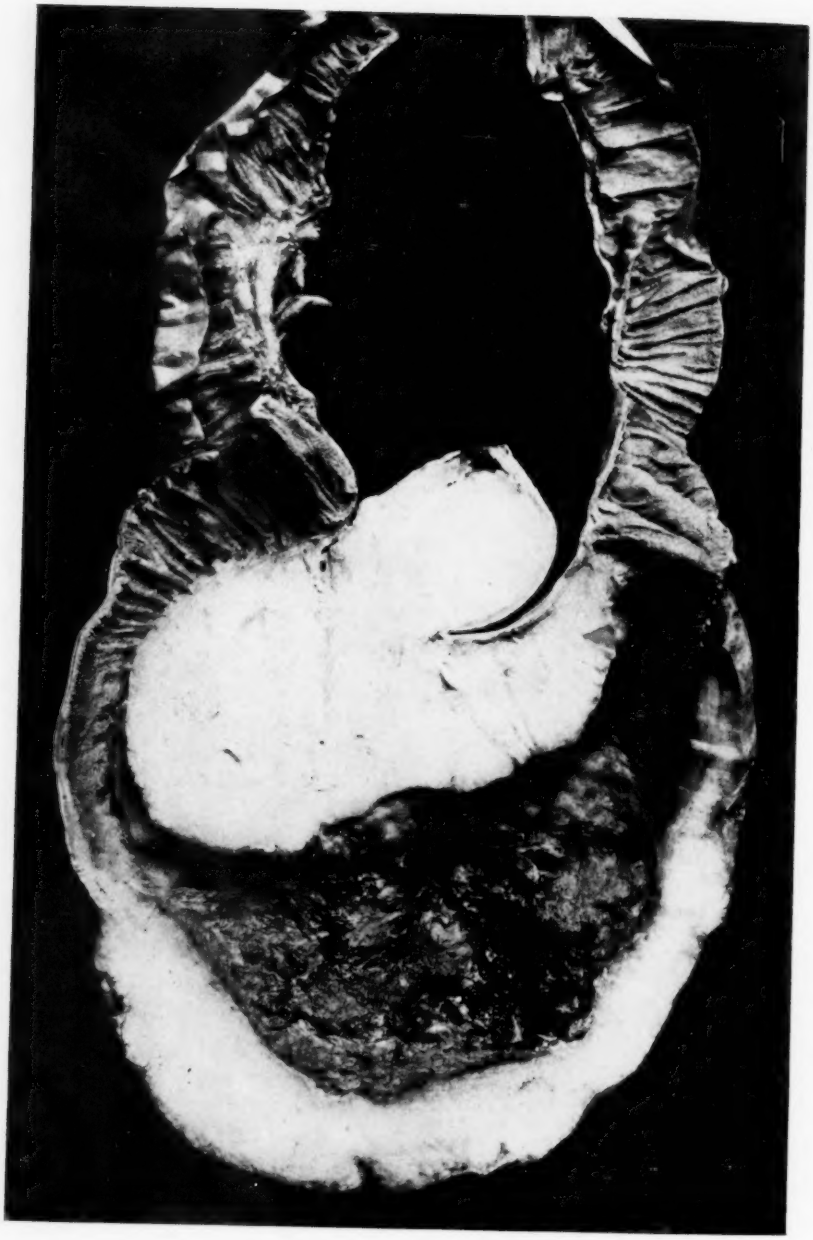

FIG. 2.—Section through the growth and intestine.

face of the tumor; the hand passed into the pelvis detected a wide band of adhesion at the posterior surface of the bladder. The great omentum was ligatured off and the bladder adhesion also; the hand passed under the tumor and it was lifted out of the abdomen. It was then discovered that a coil of small intestine ran right through the middle of the growth, as is well shown in the accompanying Fig. 1. Following the tumor upwards it was found that it encroached very much on the mesentery of the small intestine and that to remove it and yet leave a sufficient blood supply to that portion of the small intestine which remained behind a very extensive resection of intestine would be required. The blood supply to the small bowel was double ligatured, piece by piece, by the aid of an aneurysm needle thrust through the mesentery, the ligatures extending from close to the ileo-cæcal valve, upwards until it was evident that the place was reached which was above the growth and yet left the small bowel well vascularized. The mesentery was now divided between the double ligatures, and the bowel also at the extremities above and below the growth, scarcely any blood was lost and only one or two fine points needed further ligatures. The upper end of the lower piece of small intestine, which was quite close to the ileo-cæcal valve, was inverted and closed by sutures, the lower end of the upper portion of the small intestine was approximated to the lateral wall of the ascending colon by means of a Murphy button and the abdomen was closed.

A comparatively uneventful recovery followed, the pulse record was at its highest, 128, on the first night and remained above 100 for ten days while the temperature which at the end of 48 hours was 101 gradually fell to normal, the button was passed on the twelfth day. While the boy remained in bed he had two, sometimes three, rather loose motions every day; he has been kept under observation since he left the hospital and his weight has been taken on several occasions. On June 14, he weighed 30 lbs., and on July 8 the weight had steadily gone up to 36 lbs., while at the present time he is just 3 stone; he appears well in all ways, but his motions remain too frequent and often very offensive.

Examination of the removed parts shows that the tumor is a round-celled sarcoma, the origin of which may have been either in the wall of the small intestine or in the mesentery close to it;

careful measurement of the removed part of the bowel shows that it is 6 ft. 5 in. in length.

The case is of interest not only on account of the extensive removal of the small bowel and the good state of nutrition in which the boy now is, but, also, because of the little impediment to the intestinal current afforded by such a long tract of rigid and infiltrated and therefore passive intestine.

CONGENITAL LUMBAR HERNIA, AT THE TRIANGLE OF PETIT.*

BY CHARLES N. DOWD, M.D.,

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LUMBAR hernia has been a subject of scholastic rather than surgical interest, and there has been much discussion as to its exact anatomical location.

Under the following four headings are included the supposed sites of exit from the abdominal cavity which have been most discussed. (1) The triangle of Petit; (2) the superior lumbar triangle (or rhombus), described by Grynfelt[1] and Lesshaft,[2] and situated just below the twelfth rib. The ilio-costal muscle forms the posterior boundary of this space, and the external oblique the anterior; the serratus posticus inferior and the end of the twelfth rib are above it and the internal oblique below it; the latissimus dorsi lies over it. (3) A defect in the aponeurosis of the latissimus dorsi is described by Braun.[3] (4) Lieber[4] and Hartmann have described inconstant defects in the wall of the lumbar region near the triangle of Petit which could be the sites of lumbar hernia. The condition is so uncommon that few cases have been observed and very few reports of dissections have been recorded. MacReady, in his Treatise on Ruptures (1893), states that "of hernia in the lumbar region very few have been found and only one has been dissected" (not referring to those which follow abscess or injury).

In the Atlas and Epitome of Abdominal Hernias by Georg Sultan (1902), the statement is made that "post-mortem examination and exact dissection have never yet irrefutably proved that Petit's triangle formed the hernial orifice in any

* Presented before the New York Surgical Society, Nov. 28, 1906.

case of lumbar hernia," and that a similar statement could be made concerning the superior lumbar triangle. These statements were made after studying the analysis of 29 cases which Braun had made in 1879, and the 51 cases which Grange [5] and Besendonk had made at a later time.

Baracz in an exhaustive article on the subject in Langenbeck's Archives in 1902 (Bd. lxviii, s. 631–677), states that lumbar hernias are uncommon and not sufficiently understood and that only three cases are known where the place of exit was verified by autopsy. He reported and collected enough cases to bring the total number to 68, including the congenital, traumatic, and spontaneous varieties and those following cold abscess. In order to determine the most probable place of exit of these hernias he dissected the lumbar regions of 38 cadavers and published drawings of each case. He thinks that the triangle of Petit is not likely to be the site of the hernia but rather the superior triangle or rhombus already referred to. He named this the "spatium tendineum lumbale." It was present in 95 per cent. of his dissections. He called attention to the defect in the aponeurosis of the internal oblique muscle here and to the passage of the subcostal nerve and the accompanying artery and vein. He considers the next weakest spot in the lumbar region to be in the tendinous part of the latissimus dorsi where the ramus lumbalis and the ileo-lumbar vessels go through.

There has been one case of lumbar hernia shown before the New York Surgical Society, by Dr. Coley, in 1901, and he referred to another which had been successfully operated upon in the Hospital for the Ruptured and Crippled.

The condition is manifestly not common and the writer therefore presents this patient and the accompanying photograph and drawings which depict the hernia and the operation for its cure.

The child, who is three and a half years old, was brought to him when three months old by Dr. Eversfield, for a protrusion in the lumbar region. This was about the size of a goose-egg,

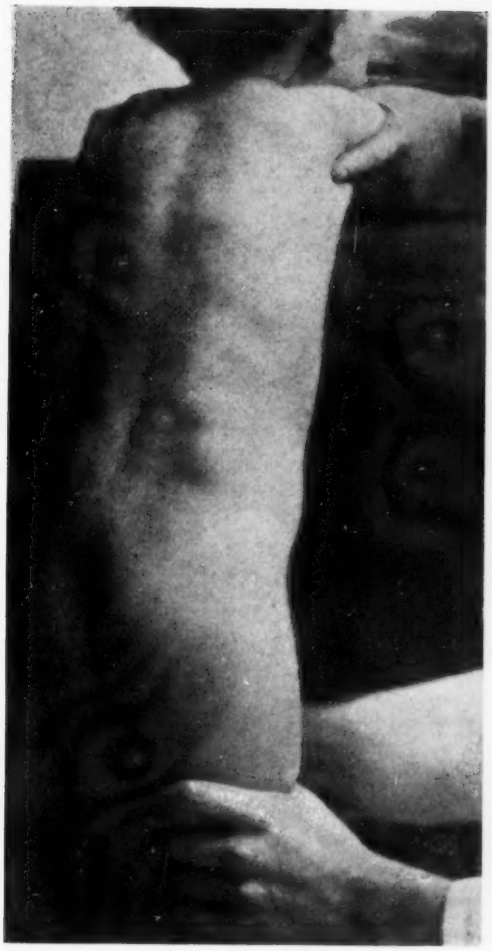

FIG. 1.—Congenital lumbar hernia, presenting through an enlarged triangle of Petit.

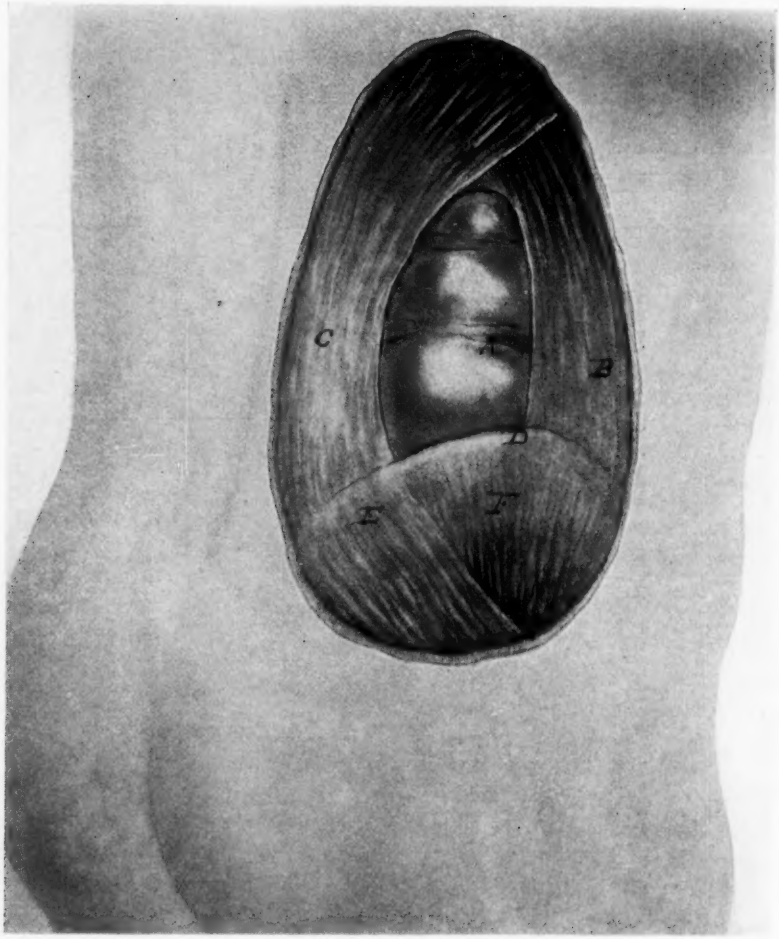

FIG. 2.—Congenital lumbar hernia. *A*, Transversalis fascia. *B*, External oblique muscle. *C*, Latissimus dorsi muscle. *D*, Crest of ilium. *E*, Gluteus maximus muscle. *F*, Gluteus medius muscle.

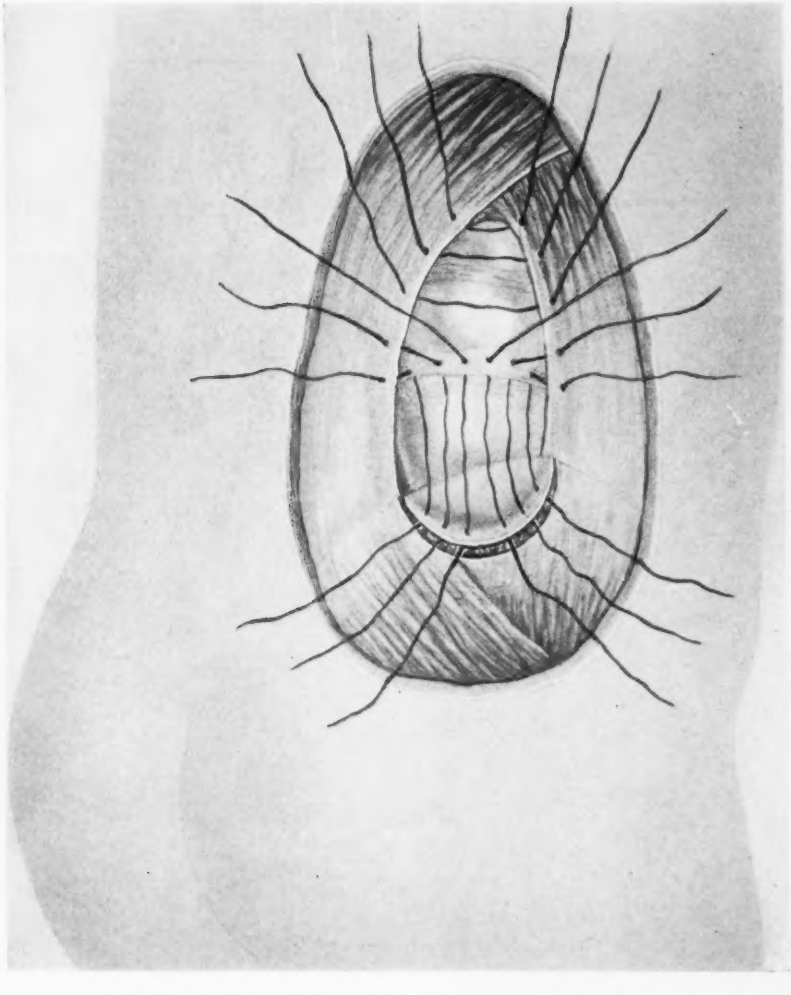

FIG. 3.—Operation for the cure of congenital lumbar hernia. Flap composed of fascia lata and aponeurotic part of gluteus maximus and medius. Stitches placed for suturing this flap to the lumbar fascia, to the external oblique muscle and to the latissimus dorsi muscle and for drawing the upper parts of the latissimus dorsi and external oblique together.

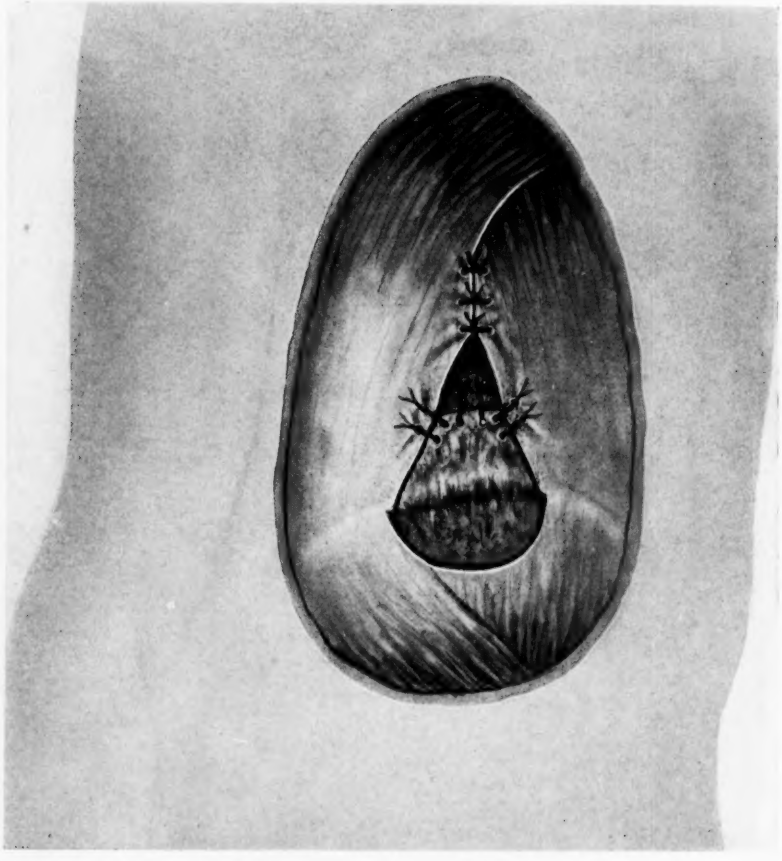

FIG. 4.—Stitches tied, leaving a triangular defect above the flap.

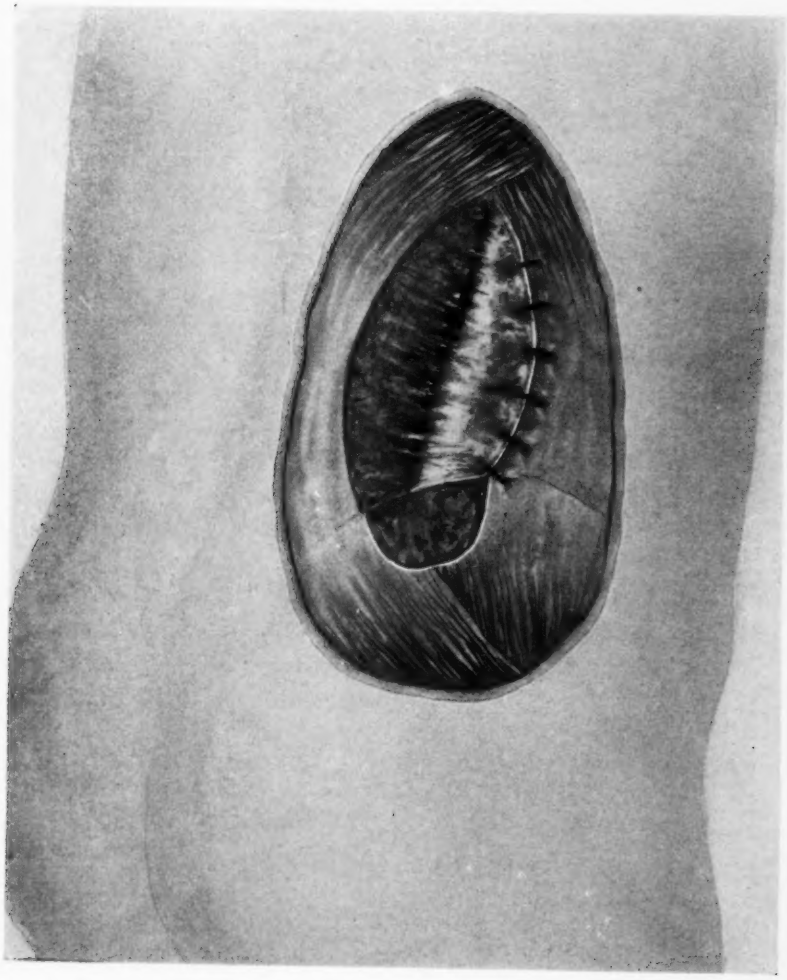

FIG. 5.—Triangular defect and sutured area covered in by a flap from the aponeurosis of the latissimus dorsi muscle.

and the margins of the hernial openings could be distinctly felt and corresponded to Petit's triangle. An elastic belt was applied and held the protrusion well in position for more than two years, but as the child grew the hernia also increased in size, and the accompanying weakness was a menace to the child and consequently a source of much anxiety to the parents. Its appearance is shown in Fig. 2. The opening was larger than the palm of one's hand and bulged in a marked way on coughing or upon exertion. There were two transverse constrictions across it, and in the lower part there was a distinct soft nodule.

On incision the hernia was seen to come through the triangle of Petit, which was greatly enlarged. The transverse bands were thickened portions of the lumbar fascia. The sac of the hernia was distinct, but there was no narrow neck. The nodule at the lower end was the appendix vermiformis. This was removed; a portion of the sac was exsected; and the tissues were then brought together from the sides; the margins of the external oblique and the latissimus dorsi being drawn together as far as possible. After this was done, there was, however, a triangular defect above the crest of the ilium. An effort was made to close this in with an aponeurotic flap turned up from below. The fascia lata and the aponeurotic tissue about the insertion of the gluteus maximus and medius formed a fibrous layer which could be used as a flap, and which was turned up, having the attachment at the crest of the ilium as a hinge. This was stitched in place with chromic gut. Some sutures passing through the previously mentioned transverse band, some through the edge of the latissimus dorsi, and others through the edge of the external oblique muscle. There was, however, still a triangular defect above the flap, and this, together with the repaired area, was covered by turning forward a flap cut from the aponeurosis of the latissimus dorsi. This was stitched to the external oblique.

The closure of the defect was satisfactory, but the operation had the prime defect of leaving a large amount of ill-nourished tissue in the wound, and much chromicized gut which was used for stitching. The greatest possible strain was put upon this tissue, since the child promptly developed pneumonia, and at a later time German measles, and there was a suppuration of the wound. In spite of these complications, however, the result is good and the lumbar wall is firm, eight months having elapsed

since the operation. He walks and holds his body well, and does not seem to suffer from the injury which has been done to the aponeurotic structures of the region.

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TUBERCULOSIS OF THE BLADDER.

BY GEORGE WALKER, M.D.,

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In the preparation of the following article I have studied 413 cases of tuberculosis of the bladder which I have collected from the literature, and 34 others from Dr. Halsted's wards in the Johns Hopkins Hospital and my private practice. I have examined the preserved tissues from cases of bladder tuberculosis, and have gone over all of the records pertaining thereto in the Johns Hopkins Pathological Laboratory. By the kindness of Dr. Cullen I have been permitted to study additional material from Dr. Kelly's gynæcological service. I have also obtained specimens of this disease which have been preserved in other institutions; and in order to observe more fully its beginning and course I have inoculated the genito-urinary organs of guinea-pigs and rabbits, and watched as far as possible the development of the morbid process.

The literature of this subject is very voluminous, and the conclusions as to the surgical treatment are various and contradictory, rendering it difficult to arrive at the truth. The general impressions, however, which I have obtained from this perusal, in conjunction with my personal experience, have led me to the conclusions set forth in this paper.

HISTORY.

Prior to the fifteenth century there are no descriptions of disease of the bladder sufficiently clear to enable one to identify instances of vesical tuberculosis. And indeed, up to the writings of Ambroise Paré there are no records of this disease. After him there is no mention made of it until Bayle cited a number of cases of genito-urinary tuberculosis, and concluded that the process might be limited to the bladder, or at least not extend beyond the genito-urinary organs.

Lænnec in 1819, in his exhaustive clinical and pathological study of general tuberculosis, found in several subjects that the disease was localized in the genito-urinary organs, and in the description of these cases he gave a very precise autopsy picture of tuberculosis of the bladder. Following him, John Howship in 1823 and Larcher in 1827 described this malady in some detail, the latter being the first to note the presence of tubercles in the vesical mucous membrane.

Cruveilhier, in his characteristically thorough manner, studied several examples of this affection, and was of the opinion that next after the kidney the bladder most frequently became implicated. No notice was taken of this observation until recently when it has been proved to be correct.

Rayer in 1841 made very accurate and beautiful drawings of various tuberculous lesions of the bladder and kidneys; several of these remain unsurpassed in clearness.

After a thorough study of a large number of cases, Wilkes in 1859 concluded that the bladder was never the primary seat, disease of the kidney always preceding its implication. Gebhard, in his admirable thesis, concurred in this opinion. Guyon and Lancereaux a few years later, on the other hand, expressed the opinion that the bladder was in most instances primarily affected, and that the kidneys were implicated by ascension. The profession seems to have been influenced largely by these teachings and to have generally adopted this view. Gradually, however, these ideas lost ground, and it is now known that the bladder is almost never the primary seat of tuberculosis. Moreover, the work of Cayle, Baumgarten, and others has proved that the disease rarely ascends to the kidney.

FREQUENCY OF BLADDER TUBERCULOSIS.

In 2390 general autopsies in the Johns Hopkins Hospital Pathological Laboratory, tuberculosis of some organ was found 710 times; in this number one or more of the genito-urinary organs was involved 160 times; the bladder was affected 22 times, but in no case was the disease primary in this viscus. The kidneys were affected 131 times (in 111 with miliary and

in 20 with chronic tuberculosis), the prostate 17 times; the Fallopian tubes 16 times; the uterus 11 times; the epididymes or testes 9 times; the ureters 9 times; the urethra 4 times; the ovaries thrice; and the vagina twice.

Saxtorph in 10,016 autopsies found 547 instances of tuberculosis of the genito-urinary organs. There were 342 instances of acute miliary processes in the kidney, but only 4 of miliary tubercles in the bladder. In 205 cases of chronic genito-urinary tuberculosis, the bladder was involved *alone* only once, but in 52 cases there was a secondary implication of it—in 38 men (622 autopsies) and 14 women (3,894 autopsies). In the 38 men the kidney was implicated 32 times, the prostate 29 times, and the seminal vesicles 20 times. In the 14 women, the kidney was tuberculous 13 times, and the genital organs 3 times.

Von Groenow in 82 deaths from general tuberculosis found 14 invasions of the genito-urinary organs, among which there were 10 bladder implications. Posner in 115 tuberculous kidneys recorded 12 infections of the bladder (autopsy report). Heiberg in 16 instances of primary genito-urinary tuberculosis in the male observed implication of the bladder 11 times. In 13 cases of primary tuberculosis in the female, the bladder was implicated 8 times. In 32 instances of secondary infection of the genito-urinary tract in the male, the bladder was affected 9 times. In 22 in the female, 9 times. In the male series, there was no instance of an isolated bladder tuberculosis; in the female there was 1. Matile, in 1726 autopsies for tuberculosis, found that the genito-urinary tract had been invaded 123 times; among this number in 19 the bladder was tuberculous.

In 31 cases of genito-urinary tuberculosis noted by Goldberg the bladder was implicated in 23. There were 35 bladder infections in 51 cases of renal tuberculosis studied by Gaultier. Jullien, after a careful examination of 41 instances of tuberculosis of the prostate, records implication of the bladder in 13. Extension to the bladder was discovered by Desnos thirteen times in 16 cases of tuberculosis of the prostate. In 23 cases

in which Israel operated for tuberculosis of the kidney the bladder had become infected in 11. Among 23 patients suffering from genito-urinary tuberculosis whose cases were recorded by Krzywicki, there were 13 who had bladder lesions.

PATHOLOGY.

The latest and by far the most comprehensive work which has been done on the pathology of tuberculosis of the bladder is by Motz and Hallé. I have adopted in part their classification and have not hesitated to draw largely on their descriptions.

We shall divide, somewhat arbitrarily I admit, tuberculosis of the bladder into the four following stages:

(1) The period of invasion and formation of tubercles.

(2) The period of superficial ulceration.

(3) The period of deeper infiltration.

(4) The period of more widespread destruction.

It is impossible to strike the boundary lines between these periods, for in some bladders they are so merged one into the other that nothing definite can be made out in regard to the stage. The third, that of infiltration, is usually the last, for the fourth, the period of destruction, occurs only seldom.

(1) Stage of Invasion.—It is rare that one has the opportunity of observing the very beginning of tuberculosis of the bladder. I have chanced on it once in a case of infection coming from the prostate.

The tubercles (according to Hallé and Motz) are usually situated in the lower half around the orifices of the ureters or in the trigone; they vary in size, from the smallest ones which are scarcely visible, up to that of a mustard seed. At first they are gray, transparent or hyaline, sometimes resembling minute cysts; others do not show this transparency, but are opaque from the onset; as they become older they assume a yellowish tinge. Both the yellow and the gray tubercles project slightly from the surface, each being surrounded by a faint rosy zone which is made up of injected blood vessels. The epithelial layer over them in the earliest stage is intact,

but gradually loses its lustre, begins to exfoliate and later becomes necrotic. As the age of the tubercle advances there is a loss of substance at the apex and the formation of an extremely minute ulcer. This last picture is very seldom seen, for usually there is a coalescence of several tubercles before the ulcer is formed.

Following very closely the above described process, there can be made out a number of other tubercles springing up very close to the older ones, which in a short time merge with them, and form a conglomerate mass the size of a pea. This appears as an opaque projecting nodule which is covered with an intact lustreless and partly necrotic mucous membrane. This stage is the immediate predecessor of the ulcer.

Histologically, the tubercle appears to develop in the capillary zone just beneath the epithelium, and just above the derma. This situation was interpreted by Clado as meaning that the infection of the bladder was through the blood, and was not a direct contamination from the urine. Such a belief, however, is contrary to clinical observation and to many pathological facts. The development, therefore, of tubercles in this region, is probably explained by the entrance of the tubercle bacilli to the deeper layers through a small crack or fissure or by direct penetration.

The very first change which the presence of tubercle bacilli brings about is a slight dilatation of the minute blood vessels; immediately following this there is a proliferation of the connective tissue which gives rise to the formation of lymphoid cells; these at first are scattered, but they soon become more or less aggregated, and in the centre of such cell masses the epithelioid type appears. As the stage advances, by the use of careful staining methods, a change can be made out in both the epithelioid and lymphoid cell; the former presents a more granular protoplasm with a less vesicular nucleus, whereas the nucleus of the latter is much more deeply stained. Just at this time one or more typical giant cells are visible, and an invasion of leukocytes occurs. The cells in the centre soon begin to show more and more signs of degeneration

until, finally, actual necrosis takes place and a microscopic cheesy mass is formed. The overlying mucous membrane at this time presents definite alterations, the blood vessels are slightly engorged, the epithelial cells have a granular protoplasm and a less clearly defined nucleus, and soon begin to exfoliate. The endothelium of the blood vessels immediately surrounding the tubercle proliferates, causing a thickening of the wall and occasionally occlusion of the lumen. The bacilli at first are more or less evenly distributed throughout the cell aggregation, but later they tend to disappear from the centre and are seen only in the periphery.

(2) Stage of Ulceration.—Occasionally one observes a necrosis of a single microscopic tubercle with the formation of an extremely minute ulcer; as a rule, however, several tubercles coalesce, necrose and slough, thus forming a much larger ulcerated area. The latter is usually the type which is first discovered and which marks the beginning of the stage of ulceration. The ulcer spreads itself irregularly in the surrounding mucous membrane, partly by the springing up and secondary necrosis of tubercles in its border, and partly by the erosion of the walls due to the tuberculous toxins.

As seen in this stage, then, the ulcerated area will measure from 2 to 5 mm. in its widest part; it is very irregular in shape, with small arms, which project into the surrounding tissue, and edges that are ragged, worm-eaten, and overhanging, or in other words, undermined; the base is covered by a very delicate anæmic granulation tissue, over which is irregularly spread a fibrinous exudate. The tissue immediately surrounding the edges is somewhat swollen, slightly indurated, and irregularly reddened. Lying in this red zone or outside of it, one can usually discover gray and yellow tubercles, which are irregularly scattered, or may form a definite ring. Two or three ulcers with their adjacent tubercles can generally be found in the same bladder; these may merge into each other, or an intact strip of mucous membrane may be left between them. Occasionally they are single, as reported by Broca, Clado, Coplin, Kümmel, Strauss, Battle, Fenwick and Burckhardt.

The ulcer, as a rule, involves the submucosa, but does not usually penetrate to the muscle; more rarely it completely erodes the submucosa and exposes the muscle, forming what is called a trabeculated ulcer; in still rarer instances it penetrates the entire muscular coat.

On histological examination, one sees that the surface of such an ulcer is covered by a thin layer of necrotic fibrin, immediately below which is tissue made up of small round cells, leukocytes, epithelioid cells, fibrinous masses, and dilated blood vessels, together with scattered cell aggregations showing a tubercular arrangement. The walls of the blood vessels show varying degrees of endothelial proliferation. In the lower layers of the ulcer, as the muscle is approached, there is an extensive round-celled infiltration, but no tubercles. Throughout this granulation tissue, tubercle bacilli are present; they are arranged in clumps, irregularly scattered among the cells with a tendency to aggregation in and around the tubercles.

Trabeculated Ulcer.—The active ulcer after eroding the submucous tissues lays bare the fibres of the muscle which in turn form its base; these being covered by only a thin layer of granulation tissue give rise to the formation of an uneven trabeculated surface. The edges of such an ulcer do not differ from those of the type first described, except that they are thicker, more ragged, and slightly more overhanging.

This type of ulceration occasionally continues to erode the muscle, and as a result ragged muscle fibres are seen projecting from the base.

Histologically the granulation base is formed of lymphoid cells, polymorphonuclear leukocytes, dilated blood vessels with an occasional attempt at the formation of cell aggregations resembling tubercles, but not usually developing into one definitely visible. The muscle itself is infiltrated with small round cells; this invasion is usually limited to the muscle immediately surrounding the base of the ulcer, but sometimes is much more extensive.

Granulation or Vegetating Ulcer.—Projecting from the

sides and base of this type of ulcer are vegetations in the form of a dark velvety fringe or definite papillomatous masses. The larger of these projections are irregular in shape and occasionally are pedunculated as a result of the erosion which has occurred on their sides. The base of such an ulcer shows only a small amount of necrotic fibrin, and the edges are not so much undermined as is usual in other forms. This variety is infrequent, and when found has resulted from a very chronic kind of tuberculosis which is neither virulent nor progressive.

Histologically these vegetations present the cellular arrangement of ordinary non-tuberculous granulation tissue; some of the larger ones contain epithelioid and giant cells, an indication that they have been invaded by tuberculosis. The tubercle bacilli are not present in those which are made up only of granulation tissue.

Another and still rarer type is seen when the muscle has become eroded; here the projecting masses contain bits of muscle as well as granulation tissue.

The muscle in the stage of ulceration is always hypertrophied from the overwork caused by frequent micturition.

(3) Stage of Infiltration.—As the ulceration increases and penetrates nearly to, or into, the already thickened muscle, the tuberculous process, either directly or by its toxins, sets up in it an inflammatory reaction which is evidenced by the widespread infiltration with lymphoid cells and leukocytes, which in turn give rise to a subsequent development of fibrous tissue. Some specimens show only such an inflammatory change; in others there is a general dissemination of the tubercle bacilli, with a consequent formation of tubercles scattered throughout the tissue. The muscle which was hypertrophied before, now becomes much more thickened by this infiltration, more irritable, and consequently more responsive to stimulation; as a result there ensues an exaggeration in the frequency of micturition. As this stage progresses, there is a degeneration of the muscle, and a replacement of it by connective tissue, which gradually interferes with its contractile power, so that the bladder becomes unable to empty itself.

The ulceration in this stage of infiltration advances and finally becomes so extensive that there is almost complete erosion of the whole mucous membrane. In one case that I have observed, the mucosa was so nearly destroyed that there remained only small fragments here and there. Fenwick observed a bladder in the infiltration stage in which all the mucous membrane was exfoliated except the trigone. Kidd, in a similar bladder, found the inside lining a mass of granulation tissue, except over a small portion of the right lateral wall. Krzywicki records an example in which entire destruction of the whole mucous membrane and extensive invasion of the muscle were noted. In an exceptional instance, reported by Haeffner, half of the bladder mucous membrane was necrotic, although the muscle was not infiltrated nor the bladder contracted. In a specimen shown to me in the Baltimore City Hospital by Dr. Rohrer, there were only a few islands of mucous membrane left, and the muscle was nearly everywhere exposed and extensively thickened by infiltration and hypertrophy.

The wall of a bladder in the stage of infiltration is always thickened, sometimes enormously so, and the whole organ is very much reduced in size, so that its capacity ranges from 100 cc. to 20 cc. Immediately surrounding the outside of the bladder there is formed a somewhat thick layer of inflammatory tissue.

The histological structure of the ulcerating surface and of the muscle in the above condition has already been described.

Caseous Massive Infiltration.—This is a rare variety of the stage of infiltration. For its production two factors are necessary: First, very virulent micro-organisms, and secondly, a very feeble resistance on the part of the tissues. In this form there is a very diffuse spreading out of the tuberculous process on the surface of the bladder and a rapid invasion of the muscular coat with widespread caseous degeneration. The mucous lining of the bladder is covered with grayish-yellow caseous masses which project and render the surface uneven; hanging here and there from these masses and the mucosa are

detached flakes of necrotic fibrin. There are few or no ulcerations. The muscle wall has been changed over a considerable extent into cheesy material, and what remains has undergone a partial disintegration. This wholesale destruction of the muscle has deprived the bladder of its tone and its power to contract, so that it is usually found distended; exceptionally it appears half contracted with rigid walls. The connective tissue outside of the muscle is rarely invaded.

Histologically there are large masses of grayish-yellow, entirely structureless material; around these areas in the still vital tissue are numerous rapidly necrosing tubercles. The muscle which remains is filled with small round cells, the individual fibres are slightly shrunken, the protoplasm of the muscle cells is granular, and the nuclei show a beginning fragmentation. Here and there one can see the outlines of single fibres surrounded by degenerated tissue, giving one the impression that the connective-tissue framework of the muscle has remained while the actual cell has vanished. Tubercle bacilli are present in enormous numbers, and frequently other organisms, particularly streptococci, have aided the work of destruction.

Diphtheroid Form.— This is a variety which is difficult to classify, but more nearly conforms to the infiltrative type than to the other processes. In this there are virulent tubercle bacilli, to which are added streptococci, or a very active form of the colon bacillus. The picture is that of an acute process, and shows an extremely rapid and extensive invasion of the mucous membrane and the muscle, which gives rise to the formation of an enormous yellowish-gray fibrinous exudate. Such a bladder has no unchanged mucous membrane; in fact, it is entirely covered by this dirty gray material, which forms a thick fluffy coat of various hues due to the different stages of necrosis. This fibrinous exudate is very intimately connected with the underlying mucous membrane and when separated from it leaves a bleeding surface. There are no ulcerations. Dittel and several others have reported such a condition of the bladder.

Histologically there is a very extensive inflammatory

reaction, as shown by a general lymphoid and leukocytic infiltration, an enormous production of fresh tubercles and extensive localized areas of necrosis, but an almost complete absence of large masses of cheesy degeneration as seen in the massive type. The picture, therefore, resembles more closely that of a streptococcus inflammation, to which has been added the formation of the multiple tubercles. The exudate is made up of coagulated and necrotic fibrin and resembles somewhat that seen in diphtheria.

(4) Stage of Destruction.—In this stage the muscular coat has been more or less completely destroyed by a rather slow chronic type of tuberculosis and has been eroded, its place being taken by a granulating membrane. The bladder has lost its contractile power and has been converted into a distended flaccid bag. Throughout this newly formed tissue the tuberculous processes may or may not be present; there are usually no active lesions and occasionally the tuberculosis has entirely disappeared. Motz and Hallé have observed and very carefully described several such instances.

Heiler found at autopsy so complete a destruction of the bladder that it was difficult to find any remnants of it; in its place was a small granulating sac, with a fistula into the vagina, through which the urine continually dribbled.

Varieties.—Casper speaks of instances in which tubercle bacilli sometimes spread over the mucous membrane very quickly and produce a picture of an acute process not unlike a true cystitis. He terms the process a tuberculous cystitis, in contradistinction to a tuberculosis of the bladder. Such a differentiation is not needed and tends to confuse rather than to elucidate. A cystitis of this kind is rarely, if ever, the product of tubercle bacilli, but is usually due to the invasion of pyogenic organisms.

Bryson has made the unique observation of what he calls a localized parenchymatous tuberculous cystitis. He observed in a male on the anterior wall of the bladder a spiral-shaped spot the size of a silver dollar, which presented over its surface dark spots, but an intact epithelium; the remaining mucous

membrane appeared normal. At first he did not understand its nature, but later, after finding tubercle bacilli, he decided that it was a rare type of a tuberculous lesion.

Stoeckel reports a very interesting condition which showed a number of polypoid excrescences; these appeared as raised pale areas, most of which were transparent; others were simple œdematous spots; and a few were grayish red. The trigone was normal except that it was very strongly injected; the bladder mucous membrane was entirely free from tubercles and ulcerations; no tubercle bacilli were to be found in the urine; but an inoculation of a guinea-pig was positive, thus proving that the process was tuberculous. I have seen a similar picture in a male, which was undoubtedly not tuberculous, but was due to the effects of an irritating substance in the urine. It seems to me, therefore, that Stoeckel's case might have been an instance of tuberculosis of the kidney, the bladder lesions being caused simply by irritating toxins. In another case, Stoeckel found definite tuberculosis of the bladder, which from time to time almost entirely disappeared, and then returned.

Mirabeau records the case of a female in whom he observed, some time before death, an ulcer in the bladder, but at the time of observation he was not able to discover any other tuberculous lesion. This ulcer was watched by cystoscopic examination and observed to heal; moreover, there was a complete subsidence of the symptoms for one year; although in the bladder, during this time, different spots of inflammation could be made out. One and a half years, presumably, according to his report, after the healing of the ulcer, the patient developed tuberculosis of the lungs and died. A second patient had several attacks of what appeared to be, from cystoscopic examination, inflammation of the bladder, but was proved to be tuberculous by the finding of tubercle bacilli in the urine; in the interval the symptoms became quiescent and the lesions in the bladder cleared up. Such an observation tends to confirm the idea of Casper. In a third instance, along with active ulcers, were found old scars which Mirabeau took to be healed foci.

Pericystitis.—In the later stages the bacilli themselves, or their toxins, probably the latter, get into the tissues immediately outside of the bladder and set up an adhesive inflammatory reaction; this produces a matting together of the bladder with the rectum, small intestines, etc. Englisch has observed and very carefully described this condition. This process does not usually show definite tubercles except in the last stage.

Mixed Infections.—I cannot state with any degree of exactness the percentage of the cases in which a secondary infection occurred, for the reason that in the majority of the reports no mention was made of the presence or absence of other organisms. In those which I have personally examined, pyogenic bacteria were absent from bladders which had not been catheterized, and present in those in which the catheter had been used. I do not mean that all infections are brought about in this manner, for there are innumerable instances in which a secondary invasion has been present without any instrumental interference. The pathological picture presented in a mixed infection differs slightly with the type of the organisms, but the picture is usually that of a tuberculous process with the addition of an ordinary inflammation. Some pyogenic organisms stimulate the activity of the tubercle bacilli; others have no effect upon them and a few are believed to even retard their growth. The organisms which have been found are colon bacilli, streptococci, staphylocci, gonococci and the proteus group. Streptococci and staphylococci, particularly the former, tend to increase the activity of the tubercle bacilli; colon bacilli do not aid their growth but produce a definite cystitis and in this way aggravate the symptoms; the proteus group sets up an ammoniacal fermentation which very greatly increases the pain and burning in urination, but possibly lessens the activity of the tubercle bacilli. Gonococci have occasionally been found; Crismore, Schüchardt, Casper, Motz and others, have reported such contaminations. As a rule the gonococci are present in the early stages and disappear in the later; they produce a gonorrhœal cystitis which renders the

bladder more susceptible to tuberculosis and sometimes seems to determine the starting point of this disease in the bladder.

Location of Lesions.—In bladder tuberculosis, secondary to the kidney implication, the first evidence is seen around the orifice of the ureter; this extends either backward or upward, involving the posterior part of the trigone and the mucosa behind it. When the disease comes from the prostate, it implicates the trigone, the neck of the bladder and surrounding tissues. There are several instances to prove that a tuberculous kidney may give rise to infection only of the mucosa around the orifice of the ureter, then skip entirely the base of the bladder and infect the prostate. I have seen such a case, and Bandler and others have recorded similar observations.

In 83 cases of my series the lesions were localized as follows: In the trigone or near it, 27 times; in the orifice of the ureters or adjacent to their margins, 23 times; in the base of the bladder, by which is meant the region behind the trigone, 10 times; in the posterior wall, 7 times; in the anterior wall, 7 times; in the vesical neck, 7 times; in the superior portion of the bladder, twice.

Le Fur out of 60 cases in 12 found the lesions in the region of the ureteral openings; in 10 in the base; in 9 on the posterior wall; in 5 on the anterior wall; in 5 on the trigone; in 3 on the neck; in 3 on the neck and trigone.

Single ulcers limited to the anterior wall have been seen by Strauss and Jacquet.

Complications.—It is relatively rare for tuberculous ulcers to penetrate the bladder wall; when perforation occurs it is usually found in the base. I have observed two instances: One in the superior part of the bladder, which extended to the rectus muscle, with abscess formation; the other perforation had occurred through the trigone into the prostate.

Guon has reported a number of ulcerations through the base. Denzel found one which extended to a pocket behind the prostate. A similar instance was observed by Dittel. Muster, in a girl of 18, discovered a fistula from the bladder into

the vagina. Barlow noted a communication between the posterior urethra and rectum. Lichtwitz and Ungerer record fistulous openings from a tuberculous bladder into the groin. Bovis noted a tuberculous fistula which ran from the bladder to the umbilicus; it was thought that the urachus had not entirely closed and had been made larger by the tuberculous process. Denzel observed an aperture from the bladder into the peritoneum resulting in peritonitis and death. Hewett examined a perforation of the abdominal wall between the umbilicus and symphysis and another breach in the same bladder which joined it with the rectum. Bryson, Pousson, Lane, Marchand and Schücking have seen fistulous tracts between the bladder and the rectum. Englisch noted a connection of the bladder with the small intestine. Winckel, in a study of 2505 autopsies in the female, detected 4 tuberculous ulcers which had penetrated the bladder wall.

McCabe and Clado found diverticula in two cases; in the record of the former the sac was larger than the bladder.

Phosphatic concretions have been observed over the surface of tuberculous ulcers, and well-formed stones have been repeatedly found. Bocaloglu and Gleize report an instance in which a large stone had formed in a tuberculous bladder, ulcerated through the rectum, and presented itself at the anal orifice.

ASSOCIATION OF TUBERCULOSIS OF THE BLADDER WITH THAT OF THE OTHER GENITO-URINARY ORGANS.

In 411 cases out of a collected series of 447, the involvement of the other genito-urinary organs was specifically stated. The result is as follows:

Bladder and kidney	119
Bladder and prostate	33
Bladder, prostate and epididymis	30
Bladder, kidney and prostate	28
Bladder and epididymis	26
Bladder, kidney, prostate, vesicles and epididymis	26
Bladder, kidney, prostate and epididymis	24
Bladder, prostate, vesicles and epididymis	23
Bladder, kidney, prostate and vesicles	13
Bladder, tubes and uterus	12

Bladder, kidney and epididymis	11
Bladder, vesicles and epididymis	11
Bladder, prostate and vesicles	10
Bladder, kidney, vesicles and epididymis	7
Bladder and Fallopian tubes	6
Bladder and vesicles	6
Bladder, kidney, Fallopian tubes and uterus	4
Bladder, kidney, Fallopian tubes and ovaries	2
Bladder, kidney and ovaries	2
Bladder, kidney and tubes	2
Bladder, kidney and uterus	2
Bladder, tubes and ovaries	2
Bladder, tubes, ovaries, uterus and vagina	2
Bladder, tubes and vagina	2
Bladder, kidney, Cowper's gland and urethra	1
Bladder, kidney, tubes and vagina	1
Bladder, kidney and urethra	1
Bladder, kidney and vagina	1
Bladder, kidney and vesicles	1
Bladder, ovaries, uterus and vagina	1
Bladder and uterus	1
Bladder and vagina	1

In 22 instances of bladder tuberculosis in the Johns Hopkins Hospital Pathological Laboratory, the other genito-urinary organs affected were as follows:

Bladder, kidney, (8 with ureter)	9
Bladder, kidney and epididymis	3
Bladder, kidney, prostate and epididymis	3
Bladder, kidney and prostate	3
Bladder, kidney and ovary	1
Bladder, kidney, prostate, vesicles and epididymis	1
Bladder, kidney and uterus	1
Bladder, prostate and epididymis	1

THE ASSOCIATION OF BLADDER TUBERCULOSIS WITH THAT OF OTHER SINGLE ORGANS.

Bladder and kidney	245
Bladder and prostate	187
Bladder and epididymis	158
Bladder and vesicles	97
Bladder and ureters	67
Bladder and tubes	33
Bladder and urethra (with prostate)	31
Bladder and urethra (without prostate)	7

Bladder and urethra (female)	4
Bladder and uterus	22
Bladder and vasa deferentia	19
Bladder and ovaries	9
Bladder and vagina	8
Bladder and Cowper's gland	1
Bladder and lungs	134
Bladder and bone	15
Bladder and intestine	8
Bladder and liver	5
Bladder and peritoneum	4
Bladder and spleen	4

Primary Genito-Urinary Tuberculosis.—I have searched the histories carefully in order to determine in what number the tuberculosis had originated in the genito-urinary tract. I have taken for granted, when the lungs are said to have been healthy, and no mention is made of implication of any other organs that the disease was probably primary in the genito-urinary tract. I have presumed also that this was first involved, when the chief description was confined to it and no mention was made of tuberculosis in any other part of the body. According to the above explanation, I found 145 cases in which the process seems to have commenced in the genito-urinary tract. They are as follows:

Lungs stated to be negative	39
No mention of other organs	54
Primary in genito-urinary organs (stated)	52
	145

Secondary Genito-Urinary Tuberculosis.—In 122 cases the primary focus was mentioned, but in 17 not definitely stated.

Primary in lungs	74
Primary in bone and joints	15
Primary in glands of neck	7
Primary in pleura	7
Primary in skin	2
Primary focus indefinite	17

Order of the Invasion of the Genito-Urinary Organs.—In 279 instances there were sufficient data to enable one to

form an approximate idea as to the invasion. The kidney seemed to be first implicated in 184; the epididymis in 80; the prostate in 6; the fallopian tubes in 6; the seminal vesicles in 2; and the uterus in 1. In perhaps many more some portion of the genito-urinary tract was the primary seat of the tuberculosis, but the history was not given with sufficient clearness to afford certainty on this point.

From the above it is seen that the two organs from which the bladder is most frequently infected are the kidney and the epididymis, the former source supplying by far the larger number of cases. From the epididymis, the disease spreads along the vas and affects the seminal vesicles and prostate, later implicating the posterior urethra and bladder. The testicle, in contradistinction to the epididymis, is so exceptionally the primary seat of disease, that practically it need not be considered as a point of origin. In my opinion the prostate is not often primarily affected, but I would hasten to add that Koenig, Tuffier, Simmonds and Krzywicki are of the contrary opinion and hold that it frequently contains the initial focus. Heiberg in a series of 31 cases of secondary genito-urinary tuberculosis, found the process limited to the prostate in three instances; but in his primary series of 14, it was never affected alone. Krzywicki in 14 collected cases of tuberculosis of the prostate records two similar examples and Collinet has also described two.

That the vesicles may provide the genito-urinary source of origin of the disease is undoubted, but it is generally admitted that the invasion is usually secondary; a few instances of tuberculosis confined to them, however, have been observed by Oppenheim, Kocher, Orth and Dreyer.

ETIOLOGY.

The bladder is very resistant to tubercle bacilli and may withstand their continued presence for months or even years without becoming infected. This has been shown numbers of times in cases of tuberculosis of the kidney, in which the urine has been full of tubercle bacilli for months and yet the

bladder has remained entirely uninfected. Experimental work also abundantly proves this point.

The bladder is rarely affected primarily; the only exception is that recorded by Saxtorph, who in 10,016 general autopsies, in a single instance found the female bladder to contain the only focus of tuberculosis in the body. Heiberg observed at autopsy a tuberculous female bladder, the remaining genito-urinary organs being free; but in this case the process was secondary to an infection in the glands of the neck.

Clinically, primary bladder tuberculosis has been reported often, but as the pathology is being more carefully studied, we are becoming convinced that these reports were erroneous. I feel justified, therefore, in saying that while primary tuberculosis of the bladder is a possibility, for practical surgical consideration its existence may be disregarded.

Tuberculosis of the lungs and of bone seem to be more frequently followed by tuberculosis of the bladder than of any other organ. In 394 autopsies which showed disease of the lungs, there were 16 instances of implication of the bladder; 13 times in connection with chronic, and 3 times with general miliary tuberculosis. In 45 cases of bone tuberculosis the bladder was affected 4 times.

Experimental Work.—I have injected virulent tubercle bacilli into the bladders of a series of rabbits under different conditions; (1) into the normal bladder, (2) into that organ after having curetted the mucous membrane; in neither series have I been able to produce an infection. I have this work still in progress and will give a full report later.

Hanau introduced tubercle bacilli into the urethra of guinea-pigs and succeeded in inducing tuberculosis of the urethra and bladder.

Rovsing has demonstrated that tuberculosis of the bladder cannot be produced by injecting tubercle bacilli into it, even if they be allowed to remain 24 hours, but he did succeed after contusing the mucous membrane and keeping the organisms imprisoned for 20 hours.

Baumgarten caused a tuberculosis of the posterior urethra,

prostate and neck of the bladder in rabbits, by instilling the bacilli deeply into the urethra.

Hansen, in 16 cases of artificial tuberculosis of the kidney, had two in which infection of the bladder subsequently developed. In 7 other animals, he injured the mucous membrane of the bladder very extensively, and then injected tubercle bacilli; 4 of these experiments gave positive results.

Pyogenic Organisms.—It is impossible to state the exact influence which pyogenic cystitis exerts upon the infection from tubercle bacilli, but it is probable that such an inflammation lowers the resistance of the mucosa, and produces minute breaks in the surface, which allow the tubercle bacilli to enter the submucosa. On the other hand, the increased blood supply and the extensive infiltration of leukocytes and lymphoid cells, together with a possible inhibiting influence of the toxins of certain pyogenic bacteria, may offer definite resistance to the tuberculous invasion.

The inhibition of pyogenic toxins just mentioned has not been proved and may not exist at all, for we see many specimens from kidneys, bladders, intestines and other organs in which pyogenic bacteria and tubercle bacilli have grown together on apparently very friendly terms. Nevertheless, it would seem that a cystitis caused by members of the proteus group or certain varieties of the colon bacilli does not offer so fertile a field for the invasion of tubercle bacilli as that produced by streptococci and gonococci. These last two organisms unquestionably are good forerunners for tuberculosis.

It can be stated, however, that in no case of cystitis, be it ever so bad, does the bladder ever become infected with tubercle bacilli even if tuberculosis of the lungs, bone or other part, exists, unless some other portion of the genito-urinary tract is implicated.

In this connection it must be insisted that all patients who have any focus of tuberculosis in the genito-urinary organs should be protected as far as possible from anything which might give rise to a cystitis, and that when such does occur it should receive more than ordinarily careful treatment.

Gonococci.—The question as to the predisposing influence of gonorrhœal inflammation is not definitely decided, but in view of the fact that a number of cases of bladder tuberculosis have followed closely upon acute gonorrhœal urethritis and cystitis, it would seem highly probable that an attack of gonorrhœa occurring in individuals suffering from tuberculosis of the kidneys or epididymes may favor the development of a bladder tuberculosis. It must be stated, however, that about 85 per cent. of adult males, and a fairly large proportion of adult females, have had a gonorrhœa at some time during their lives, so that the relationship is possibly more co-incidental than real.

In 135 cases of my collected series, gonorrhœa was stated to have been present in 71 and denied in 64. In a few the tuberculosis followed the acute attack, but in most of them it was remote.

Casper saw two instances of bladder tuberculosis develop immediately after an attack of acute gonorrhœa; so far as he could discover there had been no tuberculous focus in the body before and Casper thought that the tubercle bacilli had been directly implanted on the injured mucosa. How they gained entrance he does not state. Such a conclusion is certainly open to question.

Cornil, Babès, Motz, Hallé and Bloodgood have found gonococci and tubercle bacilli associated in the urine. Routier and Holländer have reported a cystitis which followed an acute gonorrhœa and which later was proved to be tuberculous.

Loomis, in a patient who had had for some time a cough and occasional pain in the region of the kidney, observed frequent and painful micturition following an acute gonorrhœa; the process proved to be tuberculous and ran a rapidly fatal course. It is probable that the patient had a primary disease of the kidney and that the gonorrhœa caused the bladder to become affected, thus increasing the rapidity of the whole process.

Sexual Intercourse.—It is possible that either the male or the female may become infected during coitus, but such an

occurrence is extremely rare, and the few instances which have been reported are open to doubt. If such an infection does occur, it is more likely to happen to the female, the tuberculous semen being deposited in the vagina and remaining for several days in contact with the cervix or making its way into the uterus.

Greize reports the case of a male of 37, who was thought to have been infected by a woman suffering from tuberculosis of the cervix. Gracienescu mentions the case of a female who, after cohabitation with a man suffering from local tuberculosis, developed the disease.

Schüchardt believes in the danger, and has observed a tuberculous ulcer develop on the glans penis after intercourse. In another instance he examined a female who had a very severe and acute inflammation of the vagina, the secretions from which showed gonococci and tubercle bacilli; this condition had developed after intercourse with a tuberculous male. In this connection, it is interesting to note that tubercle bacilli have been found, by Jani and Nakarai, in normal prostates and testicles of individuals suffering from pulmonary tuberculosis. The virulence of these bacilli was proved by Nakari, who inoculated them into animals. The germs may thus be present in the semen, in the absence of lesions of the genital organs, but these organisms must of necessity be few and can play no role as infective agents.

Instrumentation.—In individuals suffering from tuberculosis of the kidney, prostate or epididymis, the insertion of metal instruments, or stiff catheters, may wound the vesical neck or bladder mucosa, and afford a starting point for a bladder tuberculosis. It behooves us, therefore, in all cases of this kind to limit their introduction and, when indispensable, to practise the procedure only with extreme care and delicacy.

Means of Infection.—Theoretically the bladder may become infected by the blood or lymph, but since it is so rarely involved alone and since even in general miliary tuberculosis miliary tubercles in the bladder are very seldom found, much doubt is thrown upon the occurrence of infection through these channels.

A case occurring in the Johns Hopkins Hospital, in which some of the physicians thought that implication of the bladder had occurred in this way, may be cited as an example. The patient had had no bladder disturbance, nor change of urine during life; at the autopsy there were discovered two gray tubercles (miliary) in the trigone, and a few in both kidneys, the other genito-urinary organs being free. Here there is a possibility, of course, that the tubercle bacilli may have been conveyed to the bladder by the blood or lymph; but on the other hand, they most certainly could have come down from the kidneys.

The two principal modes of infection then, are: First, from the kidney above, and second, from the epididymes, prostate and vesicles below. The tubercle bacilli from the kidney enter the bladder in two ways: (1) They may pass by direct extension from the mucous membrane of the ureter to that of the bladder; (2) they may be brought down in the urine, and enter the submucosa through some microscopic fissure. From the prostate below, they either enter by direct invasion through the base of the bladder, or implicate first the prostatic urethra and then the bladder mucosa.

Extension from the peritoneum directly through the bladder wall is spoken of as a possibility, but there are no undoubted observations to confirm it. I have been unable to find any evidence of such a penetration in the specimens which I have examined.

It is thought to be possible by some observers that the disease may extend from the rectum into the bladder; such an occurrence I have found neither in the literature nor in my personal experience.

Traumatism.—Trauma of one kind or another may prove a predisposing factor, but there are no recorded instances to substantiate this opinion.

Diseases of the Urethra.—In cases of genito-urinary tuberculosis, inflammatory thickening, particularly when it gives rise to the formation of stricture, seems to be a predisposing factor in inciting the development of bladder tuberculosis.

Crismore, Motz, Hallé, and others have reported instances in which the stricture had a very baneful influence. Jamin observed a lighting up of a very severe cystitis, presumably tuberculous, after dilatation of a urethral stricture.

Stone has been found not infrequently associated with bladder tuberculosis. In some subjects it has preceded the development of the disease several years. Bacaloglu and Gleize report the case of a patient who had suffered a long time from attacks of cystitis which alternated with periods of improvement; these attacks gradually became worse, and at the operation a stone the size of a pigeon's egg, weighing 25 grammes, was removed; some time later tubercle bacilli were discovered in the urine, and tuberculosis of the epididymes and prostate developed.

Carleton observed a man who had complained for a long time of symptoms of bladder stone. At the operation a large calculus was found and the bladder mucous membrane was tuberculous.

In the Johns Hopkins Hospital there were about thirty small stones removed from a tuberculous bladder; calculi continued to form for several months and were taken out from time to time.

Heredity.—There were 100 cases in which were recorded notes as to the presence or absence of tuberculosis in the family; 55 patients acknowledged that some member had suffered from the disease, 45 denied it. It is probable that the hereditary tendency (as now understood) plays the same part in tuberculosis of the genito-urinary organs as it does in other parts of the body.

Habits.—The records were not full enough for me to determine whether the use of alcohol, excessive sexual indulgence, and other forms of dissipation acted as predisposing agents; my own opinion, however, is that a virtuous life does not materially lessen the chances of infection of these organs by tuberculosis.

Professions, Trades, Etc.—Accurate statistics in regard to this point were not forthcoming, but I feel sure that the

larger proportion of cases of genito-urinary tuberculosis will be found among laborers and those who have been compelled to lead lives of exposure and hardship.

Sex.—Of 438 patients of whom the sex was given, there were 285 males and 153 females. The statement of some observers that the disease is quite as common in females as in males—perhaps even more common—must certainly be incorrect, because in the male there are additional sources of infection—epididymes, prostate, vesicles, to which in the female there are no organs that are analogous in this connection. Indeed, in the female the kidney is practically the only source of infection. In order, however, to be entirely just, I will state that in this study I have been particularly interested in male tuberculosis and possibly may unintentionally have overlooked some females.

Age.—The youngest patient (condition found at autopsy) was a child of two years (Peroud); the oldest was a man of 97 (Tapret). Ammond's patient was a child of 3½ years; Horwitz's 3 years; West's 4 years; Moullin had one of 4 years, and a man of 70 years of age. The age according to decades is as follows:

IN THE MALE:		IN THE FEMALE:	
1 to 10	4	1 to 10	2
11 to 20	32	11 to 20	20
21 to 30	94	21 to 30	37
31 to 40	70	31 to 40	26
41 to 50	50	41 to 50	11
51 to 60	14	51 to 60	2
61 to 70	6	61 to 70	5
71 to 80	0	71 to 80	1
81 to 90	0	81 to 90	0
91 to 100	1	91 to 100	0
	271		104

The average age in females as obtained from 104 cases is 37.78 years; the average age in males in 271 cases is 33.26 years.

SYMPTOMATOLOGY AND DIAGNOSTIC DATA.

THERE is no one sign nor symptom, nor is there a definite symptom-complex which indubitably proves the presence of tuberculosis of the bladder. Direct inspection only can justify an absolute diagnosis. The same frequent and painful micturition and the general bladder distress which accompanies tuberculosis of that organ is also produced to nearly the same degree of intensity by tuberculosis of the kidney, and almost the same symptomatic picture is presented by certain cases of tuberculosis of the prostate. This fact has been proved often by autopsies and cystoscopic examinations. A very interesting example has been recorded by Keys, in which a patient was compelled to urinate every 5 or 10 minutes, and yet at autopsy there was disclosed no implication of the bladder.

The localized symptoms most generally met with are frequent and painful micturition, a dull aching sensation in the pelvis, and the presence of pus, tubercle bacilli and blood in the urine. The general symptoms are a gradual loss of flesh, an increasing anæmia, an irregular temperature, occasional chills, etc.

It should be stated, however, that tuberculosis of the bladder rarely presents a picture entirely due to the disease of that viscus, for the reason that some one or the other genito-urinary organs is generally implicated.

Frequency and pain with micturition will be discussed first together, because they are so often associated, and then singly.

In 294 reports in which the symptoms were given, there were 201 which gave this as a prominent complaint in some stage of the disease. In a number of others, it was not specifically stated that pain and frequency of micturition were met with together, but from other signs present, it is presumable that such was the case; if such cases are added to the above list, the proportion would be much larger, so that I do not think I should err in saying that over 95 per cent. present the combination of frequency and pain with micturition. This complex sometimes occurs at intervals, remains for a few days

or even several weeks, and then passes off almost entirely for a variable period, such free intervals and recrudescences covering several years. This type is exceptional, the general rule is a steadily downward progress, the pain becoming greater and micturition more frequent.

As an example of the above, one of my patients twelve years ago had an attack of cystitis (with frequent and painful micturition), which lasted for three days; this entirely disappeared and there was no further trouble for three years, when a second attack occurred. This was soon followed by others, and after a while the intervals became shorter and shorter until finally the suffering became continuous.

Frequency of Micturition.—In the very beginning, there is an augmentation in the quantity passed, but no change in the frequency of urination. Soon there is noted an increase in the number of times during the day, and the patient, who has before slept all night, is now forced to get up once or twice. This frequency gradually increases as the disease progresses and is accompanied by burning and pain. The intervals become shorter and shorter, the average in the later stages being from 20 to 30 minutes; in the more extreme cases, micturition occurs every 5 to 10 minutes during the day and night. Basset and Perkins observed a case in which the patient passed water every 5 minutes; Routier recorded an instance of 40 micturitions during the day and the same number during the night. One of my patients had 27 calls during the daytime. In women it is sometimes necessary to wear a napkin.

This symptom is neither relieved by rest nor increased by exercise, nor is it diminished to any extent at night. The underlying cause of frequent urination in bladder tuberculosis is the irritation of the vesical neck and floor of the prostatic urethra by the morbid process. This renders the nerve endings which normally control the phenomenon of micturition much more easily impressed; consequently the bladder becomes intolerant of much fluid. In the bladders which show an implication of the superior half, with a comparatively free base, frequent micturition is not prominent.

Pain.—At the very first pain is usually absent. As the disease advances, it becomes more and more in evidence, and toward the last stage is sometimes intolerable; it is described as dull, aching, occasionally sharp or lancinating; it is felt at the beginning of, during, or at the end of micturition; most frequently, however, pain accompanies the whole act, with an exacerbation at the end. It may be transmitted all along the urethra, or confined to the prostatic portion, and in a few patients it is felt only in the glans penis. After micturition it continues for several minutes, but is not acute, the patients describing it as a dragging, burning sensation. It is usually associated with frequency, but to this there are a few exceptions. In two cases in the Johns Hopkins Hospital, there was marked frequency but no pain. Guyon and others have noted similar instances. In a few the pain was the initial symptom and remained for some time before any other bladder disturbance was noted. It is transmitted occasionally to the perineum, to the suprapubic region, down the legs, and to the renal region; sometimes the pain is continuously present and is of a very sharp neuralgic type, extending over the whole back.

The pain is produced by the ulceration and tuberculous process in and near the vesical neck, and is intensified by the contraction of the bladder during and after micturition. When only the superior half of the organ is affected the pain is very much less and may be altogether absent.

Changes in the Urine.—It is difficult to state the exact alterations in the urine caused by bladder tuberculosis, for the reason that this process is usually complicated by tuberculosis of the kidney or prostate. Given then, an unusual condition in which the bladder has become infected from the epididymes, prostate, or vesicles, and where the focus does not communicate with the urethra, the very first change would be an increased secretion of urine due to excitation of the kidneys. Following very soon upon this augmentation in the urine, pus and exfoliated bladder epithelial cells appear, along with a few red corpuscles and possibly some tubercle bacilli. As the disease advances the pus becomes much greater in quantity, the blood

is more in evidence, and the tubercle bacilli are more readily demonstrated. Still later, in the stage of ulceration, there is added to the above debris consisting of necrotic and cheesy material.

The reaction in the majority of urines is acid: in 46 recorded analyses, 28 urines were acid, 14 were alkaline, 3 were ammoniacal, and 1 was neutral. The average specific gravity was 1018; the lowest was 1006, and the highest was 1022. The urea varied from 8 to 13 grammes per litre. The prosphoric acid (P_2O_5) ranged about 0.65. The chlorides, according to a late investigation by Bignon are usually increased, particularly when the kidney is involved. There is no reason for any alteration of the chemical constituents of the urine in tuberculosis of the bladder except as a result of reflex stimulation of the kidney; the real deviation from normal in this respect is induced by disease of the kidney.

Blood.—Hæmaturia is not so infrequently the first symptom, and may be present at intervals for a number of years, before any bladder distress or other signs show themselves.

In 146 cases bleeding was noted at some stage of the disease, in 20 it was an initial symptom. There is no absolutely characteristic sign which under all conditions will enable us to differentiate between blood from the kidney and blood from the bladder, except the evidence of cystoscopic examination. Usually the blood coming with the last portion of urine, or at the end of micturition, signifies that either the bladder or vesical neck is its source; homogenous red urine may indicate bleeding either from the bladder or kidney; if it comes from the bladder it means that there is an extensive process of some kind present; if this can be reasonably excluded, the bleeding is presumably renal in origin.

The periods of bleeding vary in duration from a few hours to several weeks and occur at intervals of weeks, months, or even years; they are most frequently met with in the first stage of the disease and tend to diminish toward the end; the quantity of blood lost, as a rule, is small; sometimes, however, it is large, and exceptionally it has been sufficient to endanger life.

Clado observed a patient who bled continuously for 1½ years. Pierchon cites an initial symptom of profuse bleeding which was prolonged for several weeks. Raymond had a patient who suffered from bleeding at intervals for 7 years before bladder distress developed. Casper's patient had had hæmaturia for 5 years prior to the appearance of any other sign of tuberculosis. In one of Raillaird's cases there was paroxysmal hæmaturia for eighteen years; in one of Talayrach's for three years. Horwitz observed one case in which bleeding occurred at intervals for three years before the cystitis began. These were all probably instances of primary renal tuberculosis.

The hæmaturia is caused in two ways. First, in the earlier stages, when there is much congestion and some ulceration, the blood is squeezed out by the contractions of the bladder; secondly, later when the ulceration is more extensive, the blood vessels may become eroded and the blood be poured out in larger quantity.

Tubercle Bacilli.—These organisms were frequently reported as absent; this I take to be the result of inadequate examinations, for a careful search will always reveal them. They were recorded as present in 110 cases—in a little over 50 per cent. of the histories in which the results of an examination were given.

The presence of tubercle bacilli in the urine does not always mean that tuberculous lesions are present in the bladder, for it has been proved that they may be excreted by the kidney and appear in the urine in the absence of any disease of the urinary tract. Israel on two occasions found them in the urine of a patient who at autopsy showed a complete absence of genito-urinary tuberculosis. Thilicwicz disclosed their presence in the urine in a case of miliary tuberculosis which at autopsy showed no local lesions. The observations of Jani and Nakarai have already been mentioned.

Pyogenic Organisms.—The most common secondary bacteria present in the urine, as before stated, are colon bacilli, diplococci, streptococci, and members of the proteus group.

These, particularly colon bacilli, are usually present in the terminal stages. Members of the proteus group are seen in the ammoniacal and occasionally in other alkaline urines. Gonococci have been demonstrated a few times.

The total quantity of urine passed in the twenty-four hours varies with each individual case, but is liable to be somewhat above normal. The smallest quantity, 800 cc., was observed by Battle in a ten-year-old girl; the largest amount, 2500 cc., occurred in a male of 47 (Bignon); the average quantity was 1660 cc. Sondern in 74 cases found the average to be 1430; the largest was 2200 cc. and the smallest was 720 cc.

The capacity of the bladder is diminished. This as demonstrated in 41 cases averaged 97 cc.; the smallest was 20 cc. (Catron) and the largest was 420 cc.; of these 41 bladders, 27 had a capacity of under 100 cc.

Cystoscopic Examination.—In the bladders which have been infected from the kidney, we see on the corresponding side on cystoscopic inspection an irregular ureteral orifice with some swelling and redness on the edges and a slight congestion of the surrounding mucous membrane, with the occasional presence of a few reddish papules. This picture does not represent a true tuberculosis, but is rather that of irritation produced by the tuberculous toxins. Later there is seen an increase in the red zone and the formation of definite tubercles which appear as fine gray points with a faint reddish zone surrounding them. In a short time this picture is succeeded by another, which shows a development of more tubercles, with an aggregation, coalescence, and secondary loss of substance, and the consequent formation of one or more minute ulcers. The mucous membrane in this stage is otherwise normal, except for a slight congestion in the trigone and vesical neck. A still later examination discloses an extension of the ulceration toward the trigone, or upward and backward on the posterior and lateral surfaces. Following this increased ulceration, the whole mucosa not infrequently becomes injected and slightly swollen, and presents the picture of a cystitis; this is particularly true when there has been a secondary invasion. In the

last stages there is a very extensive ulceration of most of the mucous membrane and in many places an exposure of the muscular coat.

When the disease comes up from the prostate, nearly the same picture is presented with the exception of the above mentioned initial and probably non-tuberculous stage; the lesions, of course, are differently located, being near the vesical neck and in the trigone. In this type there seems to be a more rapid development of tubercles, with an earlier breaking down and ulceration, the more rapid course being probably due to the situation of the lesions which are thus subjected to more irritation from the contractions of the bladder.

Tuberculous Ulcer.—The outline is irregular; there is a general tendency toward a circular form with irregular projections; the edges are ragged, red, swollen, slightly indurated, and overhanging; the base is covered with an uneven, very delicate granulation tissue, over which are scattered yellow and gray flakes of fibrin. The mucous membrane immediately surrounding the ulcer is diffusely reddened and no individual blood vessels can be seen; outside of this is a less reddened zone, where they are more distinct. The ulcer varies in depth; usually it does not penetrate farther than the submucosa tissue, but occasionally it passes through this and exposes the muscle, which in turn it erodes.

According to descriptions found in the literature, the ulceration in a majority of instances begins in the region of the ureter; the individual ulcers range in size from that of a pin-head up to that of a silver dollar; usually several are present, but single ones have been noted by Strauss, Reynès and Battle.

Unusual Conditions.—Stoeckel observed a bladder whose base was covered with polypoid excrescences; these were very small, and for the most part were translucent; some of them were slightly reddened; there were no tubercles, no ulcers; tubercle bacilli were not found at first, but were discovered later. Mirabeau has made a similar observation in a case which also proved to be tuberculous.

Malherbe saw a brownish mass which at first was taken for a tumor, but later at operation was shown to be a tuberculous process.

Incontinence.—Three kinds of incontinence are met with: (1) The true form which is brought about by the destruction of the vesical neck; (2) that of dribbling from over-distention; (3) that caused by an exaggerated and imperious desire to micturate. True incontinence is observed only in the last stages, when the disease has become extensive, infiltrative and destructive. The over-distention type is produced either by some obstruction in the prostatic region, or by grave implication of the muscle which weakens it and allows the bladder to distend. In the last form the urine begins to flow as soon as the desire is felt.

Retention of urine is sometimes seen. It occasionally appears very early, and the first thing that draws the attention of the patient to any abnormal state is that he suddenly becomes unable to urinate and is compelled to have recourse to a catheter. Retention is brought about in four ways: (1) By irritation around the vesical neck which produces a spasmodic constriction; (2) by the implication of the prostate or the swelling of the tissues around the neck of the bladder which forms an obstruction; (3) by hindrance of the outflow by a blood-clot; (4) by more or less complete destruction of the muscle wall of the bladder which so weakens it that the viscus has not sufficient force to expel the urine.

Tuberculosis of the Bladder Without Symptoms During Life.—Every now and then one finds at autopsy a more or less extensive disease of the bladder which has produced no symptoms before death. In such instances it is usually the superior half of the viscus which has been invaded.

Stein saw at autopsy a number of ulcerations at the summit of the bladder, the patient having complained of no disturbance of micturition. Kidd observed a very extensive ulceration of the mucous membrane, which had caused no bladder distress. Smith saw a single ulcer which was not known to have caused any discomfort before death. In three

patients in the Johns Hopkins Hospital there had been no trouble with the bladder, but at autopsy lesions were found; in the first there was a decided implication of the mucous membrane; in the other two there were several fine gray tubercles in the trigone.

Loss of Flesh.—In the early stages of bladder tuberculosis, the patient retains his weight to a remarkable degree and occasionally gains from time to time; it is the rule, however, in the latter half to have loss of flesh, which in the terminal stages becomes rapid. This cannot all be ascribed to the disease of the bladder, for there are other tuberculous foci present which are preying upon the patient. Again, the emaciation is in part directly due to exhaustion and loss of sleep, caused by the frequent and painful micturition.

Anæmia.—A certain degree of pallor is observed very early, although some persons retain their color for a long time; later the anæmia is very pronounced and the blood presents the same changes as in tuberculosis of other organs.

Fever.—This is a late symptom, is of irregular type and ranges from 99° to 103° F. Chilly sensations and occasionally definite rigors precede the rise in temperature.

Pulse.—The pulse sympathizes with the general weakness and the temperature.

Complications.—The main complications are infection by pyogenic organisms, stone, stricture, and prostatic abscess. Secondarily, of course, we may have those following perforation of the ulcer into the surrounding structures. Infection by pyogenic bacteria and the presence of stone have been discussed already. Stricture has been observed several times in this connection, and often aggravates the other symptoms and increases the rapidity of the course of the disease. Typical instances have been recorded by Motz, Crismore, and others. Prostatic abscess often complicates tuberculosis of the bladder; it produces retention, great increase in the pain, local swelling and discomfort in the perineum. Perforation into the large or small intestine, may allow all the water to be discharged into the bowel, greatly increases the suffering, and hastens the

end. Perforation into the peritoneum produces peritonitis and death. Opening into the perineum, behind the prostate, or into the suprapubic region gives rise to abscess formation with its consequent train of symptoms.

Duration of Symptoms.—Inasmuch as bladder tuberculosis in every instance is complicated by other conditions, such as tuberculosis of the kidney or prostate, primary stone and primary simple cystitis, it is impossible to state with precision how long tuberculosis of the bladder had been present in the cases which I have analyzed. In the following calculation I have estimated the time from the date of the first symptoms up to the time at which the patient first came under the observation of the recorder of the case. This method must of necessity be inaccurate, for the records are indefinite—for instance, the following phrases are used: "Blood at intervals for 5 years, later painful and frequent micturition;" "Cystitis to some extent for 10 years, several years later increased frequency with pain;" "Symptoms of stone for 4 years; then tuberculosis developed." Such cases may or may not have been tuberculous from the beginning; possibly in some the process at first was simple and a tuberculous infection occurred only later. With the above explanation, I will state that I have computed the time in 172 cases, and find that the average duration of the bladder tuberculosis from the beginning up to the date of the history is 25.21 months. The shortest time was 14 days and the longest 11 years. The duration of symptoms from the beginning to the time of death, as calculated from the histories in which the dates were given, is 35.05 months, or in round numbers 3 years.

(To be continued.)

RECURRENT INTERMITTENT RETENTION OF URINE OCCURRING WITH THE REMISSIONS IN A CASE OF PERNICIOUS ANÆMIA—THE FINAL RESULT OF A BOTTINI OPERATION FOR ASSOCIATED PROSTATIC HYPERTROPHY.

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THE interest in this case is the recurrent intermittent retention of urine dependent upon remissions or exacerbations of anæmia in the course of a pernicious anæmia.

The purpose of this report is not to arrive at any definite conclusions, but to place on record an etiological factor producing intermittent retention of urine not heretofore mentioned, so far as the writer is aware. The case also illustrates the sequelæ of urinary retention; the benefit derived from a Bottini operation and the condition of the prostate three years following such an operation.

The changes in the blood during the course of the case are also of interest.

Male; widower; 47 years old; a native of New Brunswick; a teamster by occupation; entered the Boston City Hospital in the medical service of Dr. Henry Jackson, March 18, 1903. I wish to express my appreciation to this gentleman for the privilege of using the notes of this case while on his service.

Family History.—Father died of cancer of the throat; mother and wife with pneumonia; one child with tubercular meningitis. Two children living and well. No brothers or sisters.

Past History.—Measles in childhood. Otherwise always well. Denies venereal.

Habits.—Moderate use of tea, liquor and tobacco.

Present Illness.—For the past few weeks the patient has been unable to work on account of the fact that he becomes tired very easily. Headache has been a constant symptom, most

marked during the day. He becomes dizzy and gets out of breath on slight exertion. During the past week he has had difficulty in distinguishing objects, both far and near. During the past few weeks his appetite has been very poor and there has been a constant diarrhœa, not containing blood. Does not vomit. No cough. He has had several attacks of "palpitation of the heart," at which time he has felt dizzy and has been obliged to sit down. These attacks have lasted but a few moments, and have occurred after exertion.

There has been a gradually increasing frequency of micturition during the past five years, and four years ago he had complete retention, at which time he had to be catheterized regularly for three months. When he was not catheterized the urine dribbled away, but he was unable to pass any voluntarily. The patient states that he now passes his water six or seven times during the night and every hour or two during the day; that there has been increasing difficulty in starting the urine; that it comes slowly and drops directly from the meatus; and that dribbling follows the act. He states that the urine is cloudy and that a sediment settles to the bottom of the vessel. There has been no pain associated with urination, and he has never passed blood.

The patient states that he has not lost much weight. His chief complaint is weakness, headache, vertigo, and a difficulty in urination.

Physical Examination.—A well developed and nourished man with a yellowish pallor. Eyes: pupils, motions, and reactions normal, no arcus senilis; conjunctivæ, pale. Tongue: thick white coat, pale in color. Throat: very pale. Pulse: equal, regular, fair volume and tension. Heart: right border two fingerbreadths to right of sternum; left border in nipple line; apex in fifth interspace, nipple line; upper border, third rib; action regular; a soft blowing systolic murmur is heard at the apex and is transmitted into the axilla; the aortic second sound is accentuated. Lungs: good resonance, but numerous, sonorous, sibilant, and medium moist râles are heard throughout both chests. Liver dulness extends from the sixth rib to costal margin; edge not felt. Abdomen full, lax and tympanitic, not tender. In the hypogastrium a rounded tumor is palpable, extending half way to the umbilicus, which mass resembles a partially distended

bladder, both by palpitation and percussion. Extremities: moderate œdema about both ankles. Knee jerks and planter reflexes slightly increased. No glandular enlargement. There is a small inguinal hernia on both sides.

Rectal Examination.—Right lobe of the prostate slightly larger than the left. The median raphe is forced toward the left, the left lobe being normal in size. Both lobes smooth and of normal consistency, but the right lobe is rather less sensitive than the left. Both seminal vesicles are normal. Small external hæmorrhoids are present.

The urethra not instrumented. Temperature, 99°; pulse, 104.

Urine Examination.—Pale and turbid; sp. gr., 1005; alkaline; a trace of albumin; no bile or sugar; urea, .78. Moderate amount of sediment, which shows pus and squamous epithelium. No renal elements or crystals.

Blood Examination.—Leukocytes, 6000; red cells, 1,625,000; Hgb. 25 per cent.; marked poikilicytosis, macrocytosis and polychromatophilia. A differential count shows: Neutrophiles, 79 per cent.; basophiles, 19 per cent.; eosinophiles, 2 per cent. Three megaloblasts. One mast cell.

The patient was given Fowler's solution, iron preparations, and urotropine. He continued to run a temperature about normal and a pulse around 100.

Blood Examination.—Three days following entrance: Leukocytes, 8000; red cells, 1,200,000; Hgb., 15 per cent. Marked macro-, micro- and poikilocytosis and polychromatophilia; twelve megaloblasts and four normoblasts.

Five days following admission the patient complained that he was unable to pass any water. A tumor was evident over the pubes extending to the umbilicus and urine was issuing from the meatus in drops.

Urethral Examination.—A bougie à boule, No. 28 Fr. was passed to the anterior layer of the triangular ligament and withdrawn without meeting obstruction. A soft rubber catheter, No. 12 Fr., could not not be passed into the prostatic urethra. A coudé, No. 12 Fr., was passed into the prostatic urethra, where it deviated about 30 degrees to the left during its passage through this portion of the urethra. Forty-five ounces of urine were withdrawn, and no hæmorrhage resulted. The coudé was tied in

position and siphon drainage established. The bladder drained well for four days, and was irrigated daily with a 4 per cent. boric acid solution, the twenty-four hours' amount of urine ranging between 38 and 45 ounces.

The examinations of the urine made were as at entrance. After the bladder had been drained for four days the catheter was removed because it became plugged with sediment. Following the patient was able to pass but a very small amount of urine at a time, and the bladder was constantly overflowing. A residual urine of 38 to 42 ounces was found at several different times.

The patient's chief complaint after being in the hospital one week was the retention of urine, and it was believed that the obstruction was due to prostatic hypertrophy.

Fourteen days after admission a cystoscopic examination was performed by the writer through the courtesy of Dr. Henry Jackson and Dr. Abner Post.

Cystoscopic Examination.—A soft rubber catheter, No. 12 Fr., was passed into the bladder, meeting obstruction in the prostatic urethra; 800 cc. of dirty urine withdrawn; bladder cleaned in about twenty minutes; bladder capacity, 850 cc.

The deep urethra and bladder were cocainized by an ounce of a 4 per cent. solution; 250 cc. of sterile water was introduced as an examining medium.

A simple concave, indirect cystoscope was introduced easily to the apex of the prostate. When forced into the prostatic urethra, it met obstruction and the beak deflected to the patient's left to about 30 degrees, and remained so during its passage through the prostatic urethra into the bladder. The bladder wall showed large rougæ deeply injected with many flacks of adherent fibrine (*chronic cystitis*). The trigone was distinct, and also deeply injected. Both urethral orifices were found with an areola of dark congestion about them. They were normal in size and functionating at a normal rate. The urine ejaculated was clear. The vesical surface of the prostate showed two distinct clefts to the right of the median line. (See Fig. 1.)

There was slight intravesical projection of the right lobe. No growths or foreign bodies seen.

Bimanual examination performed with the cystoscope in the bladder and the finger in the rectum. The prostate showed the right lobe to be slightly larger than the left. The consistency

rather firmer than normal. The left lobe normal in size and consistency. The surfaces of both smooth. The bladder wall is slightly thickened. The prostatic tissue posterior to the urethra not more than 1.5 cm. Tissue to the right of the prostate urethra over 3 cm.

Rotation of the beak over the vesical surface showed the right lobe to project about 2 cm. above the vesical orifice. The elevation was gradual in its decline anteriorly and posteriorly.

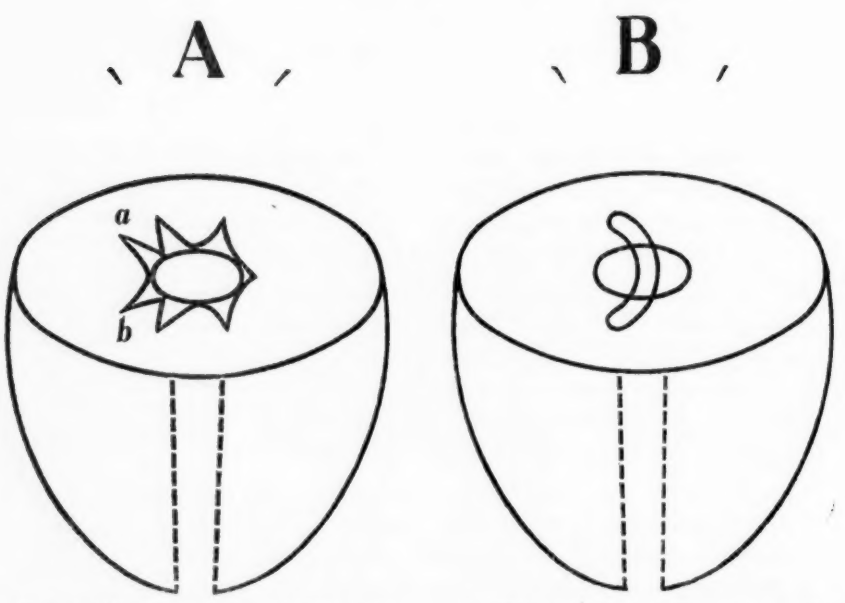

FIG. 1A.—Diagrammatic record of the cystoscopic fields at the vesical outlet, showing two clefts, *a*, *b*, a short distance to the right of a median line.

B.—The actual shape of the vesical orifice determined by transposing the inverted cystoscopic pictures recorded in A, showing the incroachment of the right lobe upon the urethra, deviating it to the left, narrowing it laterally and lengthening it antro-posterially.

The prostatic urethra was but slightly lengthened. In withdrawing the instrument the beak was rotated about 30 degrees to the left, where it remained during its withdrawal through the prostatic urethra. The passage was even and the resistance continual.

Part of the distending medium was passed voluntarily by the patient immediately after examination. It contained no blood, but was slightly turbid.

The patient voided his urine rather better for three days following the cystoscopic examination, as is so often the case,

but at the catheterization which was practised night and morning, the residual urine ranged between 28 and 36 ounces, and without the catheterization, the bladder became overdistended and dribbled constantly. The anæmia continued about the same, the patient's general condition not being improved.

Bottini operation, twelve days following the cystoscopic examination, performed through the courtesy of Dr. Henry Jackson and Dr. Abner Post.

The operation was performed under local cocaine anæsthesia. The 1.2 cm. blade was used. The right lateral lobe was incised at a mid-point for a distance of 1.75 cm. at the rate of one minute to the cm. out, and 30 seconds of the first cm. back, and one minute on the last .75 cm.

There was no pain during the operation except at the last .25 cm. going back. The cautery blade could not be heated beyond a dull red heat, because of some defect in the electrical connections.

It was originally intended to make two other incisions in the right lateral lobe, one on either side of the median incision. The operation was considered to be incomplete, and the patient was returned to the ward with the idea of repeating the procedure when the electrical apparatus was repaired.

Following Operation.—No suppression followed. The patient began to void his urine voluntarily. The urine was voided in three- or four-ounce amounts at short intervals. The urine contained considerable blood and bits of sloughing tissue for about a week. These gradually disappeared.

Ten days following operation, the patient was catheterized for the first time, and a residual urine of 12 ounces was obtained. A soft rubber catheter, No. 18 Fr., was passed without difficulty. There was so much improvement in the patient's condition that further operative procedure did not seem advisable at that time.

The residual urine was tested every three days, and five weeks after operation was reduced to 6 ounces. The patient held the urine at longer intervals, from three to four hours, and passed it but twice during the night. The urine started easily, and passed freely, but the dribbling after urination persisted. Examination of the urine was not different from that at the time of admission, except that the sediment contained a small amount of detritus, and a few blood corpuscles.

Blood examination at this date, five weeks after operation, was: Leukocytes, 5,622; red cells, 1,340,000; Hgb., 25 per cent.

The patient had gained considerably in strength, despite the fact that the blood examination was not materially changed during his stay in the hospital.

The improvement in the function of urination seemed to relieve the patient of most of his symptoms except weakness, and he desired to be discharged from the hospital.

The cystoscopic examination at this time, six weeks following operation, was as follows:

Cystoscopic Examination.—The bladder was entered with a soft rubber catheter, No. 18 Fr. The residual urine was 3 ounces; urine nearly clear; bladder washed clean in two minutes; bladder capacity, 400 cc.; 320 cc. of sterile water as examining medium. A simple, concave, indirect cystoscope passed without difficulty into the prostatic urethra, through which it passed with a deviation of about 10 degrees to the patient's left. The bladder rougæ distinct, but small, partially perhaps because of the large degree of distension by the examining fluid. The bladder wall was slightly injected everywhere; trigone distinct and but slightly injected. Both uretal orifices normal in appearance. The urine ejaculated clear. The vesical surface of the prostate as in Fig. 2. The right lobe, the one which was incised, shows a concavity which is rounded in outline throughout nearly its whole antro-posterior diameter. The limit of the convexity on the vesical surface is visible, showing that more tissue has been destroyed in the middle of the lobe, and that the destruction has not quite extended to the peripheral edge of the lobe.

Bimanual examination with the cystoscope in the bladder and the finger in the rectum showed the tissue posterior to the urethra to remain about 1.5 cm. and the left lobe to remain about 2 cm., but the latter is more prominent than the right lobe, which is less than 2 cm. on its vesical surface. The elevation which was present on the right lobe at the previous examination is absent, the cystoscope not being drawn in during its rotation. The left lobe, by rectum, is larger than the right. The right lobe, however, still remains the harder. There is no induration and the surfaces are smooth. The median raphe is still slightly convex to the left.

After Discharge from the Hospital.—On September 1, 1903,

three months after the patient's discharge from the hospital, an examination of the bladder showed a residual urine of but 3 dr. The patient passed his urine but once during the night, and held it for from three to five hours during the daytime. There was no pain, and no difficulty in starting the urine, which came in a fair stream and which had more projection than at any time since he had been under observation. There was practically no

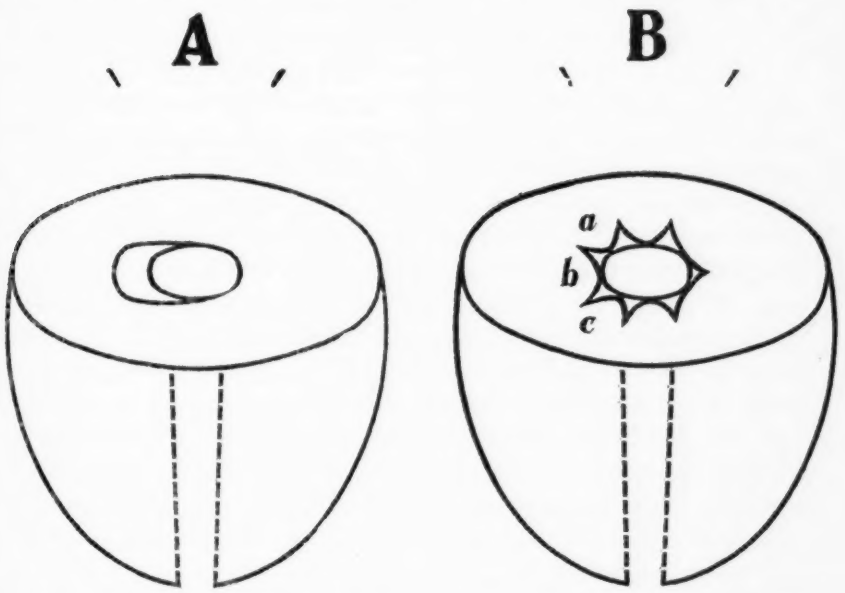

FIG. 2A.—Diagrammatic record of the cystoscopic fields at the vesical outlet, showing three deep convex fields, *a*, *b*, *c* in the right lobe.

B.—The actual shape of the vesical outlet determined by transposing the cystoscopic pictures recorded in A, showing the enlarged vesical outlet produced by sloughing away of the tissue about the incision. (Compare with photograph of the specimen.)

dribbling. The anæmia was much improved. The white cells were 6,500; red cells, 3,500,000; hæmoglobin, 45 per cent.

In November, 1903, the patient was readmitted to the Boston City Hospital on the service of Dr. John L. Ames, because of a return of the anæmia and its associated symptoms. I wish here to express my thanks to Dr. Ames for placing the record at my disposal.

Blood Examination.—Leukocytes, 8,000; red cells, 912,000; Hgb., 25 per cent.; achromia and poikilocycotis marked. Differential count: Neutrophiles, 67.6; basophiles, small, 22.5;

basophiles, large 5.3; eosinophiles, 4.6; no normoblasts or megaloblasts.

The patient had been growing weak for about ten days, and during this time had noticed an increasing difficulty in performing the act of urination.

A large soft rubber catheter was passed into the bladder without difficulty, and 12 ounces of residual urine was withdrawn.

The ease with which the catheter was passed showed that the prostatic urethra was of fairly large calibre.

Urine Examination.—Pale; slightly acid; slight trace of albumin; sp. gr. 1010; small amount of sediment consisting of a small amount normal blood; some pus; a few hyalin casts, with blood and renal cells adherent; occasional brown granular casts; much squamous and round cells epithelium.

The residual urine constantly increased in amount with the progression of the anæmia, and six weeks later the right kidney could be felt when the bladder was full but not so when empty. The residual urine had reached 36 ounces, and the twenty-four-hour amount ranged between 85 and 100 ounces. The anæmia at this time was most pronounced.

Blood Examination.—Leukocytes, 8,800; red cells, 656,000. Differential count: Polymorphonuclears, 73 per cent.; basophiles (small), 6 per cent.; basophiles (large), 18.5 per cent.; eosinophiles, .5 per cent.; transitional, .1 per cent.; two megaloblasts and one normoblast.

Urine Examination.—Pale; neutral; sp. gr., 1.008; slight trace of albumin. Considerable sediment, consisting of pus, normal blood, some small round cells and squamous epithelium; some neck of bladder cells; no casts.

As the anæmia began to improve the patient experienced less difficulty in the act of urination, and after a stay of three months in the hospital the anæmia had greatly improved and its symptoms were absent. The residual urine at this time had dropped to 10 ounces.

Blood Examination.—Leukocytes, 11,300; red cells, 2,928,000. Differential count: Polymorphonuclears, 71.2 per cent; large mononuclears, 6.2 per cent.; small mononuclears, 17.3 per cent.; eosinophiles, 4.5 per cent. Eight mast cells and no blasts.

During the next month the anæmia continued to improve, and the residual urine dropped to five ounces.

There was again a remission of the anæmia and the residual urine gradually increased in amount as the general weakness progressed.

He was admitted to the Long Island Hospital April, 1904.

The general physical examination was as noted at the City Hospital. The blood examination at this time was: Leukocytes, 6,400; red cells, 472,000; Hgb., 10 per cent.; some poikilotytosis and achromia. Differential count: Basophiles, 32 per cent.; neutrophiles, 68 per cent. No eosinophiles or blasts.

The bladder was overflowing constantly and an effort to urinate resulted in the passage of only a few drachms. There was no obstruction to the passage of a No. 18 Fr. soft rubber catheter.

Urine Analysis.—Pale; acid; sp. gr. 1014; slightest possible trace of albumin; no bile or sugar. Considerable sediment, consisting mostly of pus. Occasional calcium oxylate crystals and a few small and large epithelial cells.

This attack of anæmia was not so pronounced nor did it persist as long as his previous attacks, and six weeks after his admission to the Long Island Hospital the red cells had increased to 1,616,000, there was only slight achromia, one megaloblast and no normablasts, and the Hgb. had risen to 30 per cent. At this time the bladder emptied itself except for two drachms. Micturation occurred every two hours during the day and but twice at night. The stream was a little slow in starting, came in fair volume with but little projection and there was slight dribbling after the act.

Urine Examination.—Normal color; normally acid; sp. gr. 1011; slightest possible trace of albumin. Small amount of sediment, chiefly pus, with occasional squamous epithelial cells.

The patient continued to gain in strength, and in July, 1904, he was out daily and able to do light work. The Hgb. at this time was 75 per cent. The bladder emptied itself except for three drachms. Urination occurred every four hours during the day and once or twice during the night. The stream started without difficulty, was of good volume, and had fair projection. A No. 20 Fr. soft rubber catheter could be passed into the bladder without difficulty. The urine was normal in color with but little sediment.

The patient's general condition remained good, and in Jan-

uary, 1905, bladder symptoms were absent and the residual urine was but three drachms. The blood examination at this time showed red cells, 2,960,000; Hgb. 45 per cent. Differential count: Neutrophiles, 81 per cent.; basophiles, 18 per cent.; eosinophiles, 1 per cent. One normoblast and three megaloblasts.

In May, 1905, bladder symptoms were absent and there was a residual urine of two drachms. The patient's general condition was good and he was discharged from the hospital.

The patient did light work and remained in fairly good general health for four months. He was readmitted to the Long Island Hospital in August, 1905, on account of a remission of the anæmia and its accompanying symptoms. The patient had lost much in general condition and had complete retention of urine.

This attack of anæmia was pronounced in severity and his general condition remained poor, and the bladder had to be emptied regularly by the catheter for nearly four months. The red corpuscles dropped as low as 1,408,000 and the Hgb. to 15 per cent. The urine became very turbid, the albumin increased, and there was much sediment, consisting of pus, squamous epithelium, casts and renal elements.

About four months after readmission to the hospital there was a gradual improvement in the patient's general condition and the red cells reached as high as 2,400,000 and the Hgb. 50 per cent. At this time the bladder emptied itself except for one ounce.

This improvement was of short duration, the anæmia returned and the patient became very weak. There was complete retention of urine.

Blood Examination.—Red cells, 1,004,000; Hgb., 20 per cent.; marked achromia and poikilocytosis. Differential count: Basophiles, 30 per cent.; neutrophiles, 67 per cent.; eosinophiles, 3 per cent.

The patient failed rapidly from this time on, became uræmic, and died one week later.

Following is the autopsy report of the urinary tract, made by Dr. S. B. Walbach, pathologist at the hospital, and also a photograph of the specimen (Fig. 3):

Kidneys.—Both kidneys tightly adherent to surrounding fat and muscle tissue. The left kidney is apparently one-third smaller than the other. Both are soft, lobulated, fluctuant. On section both are found

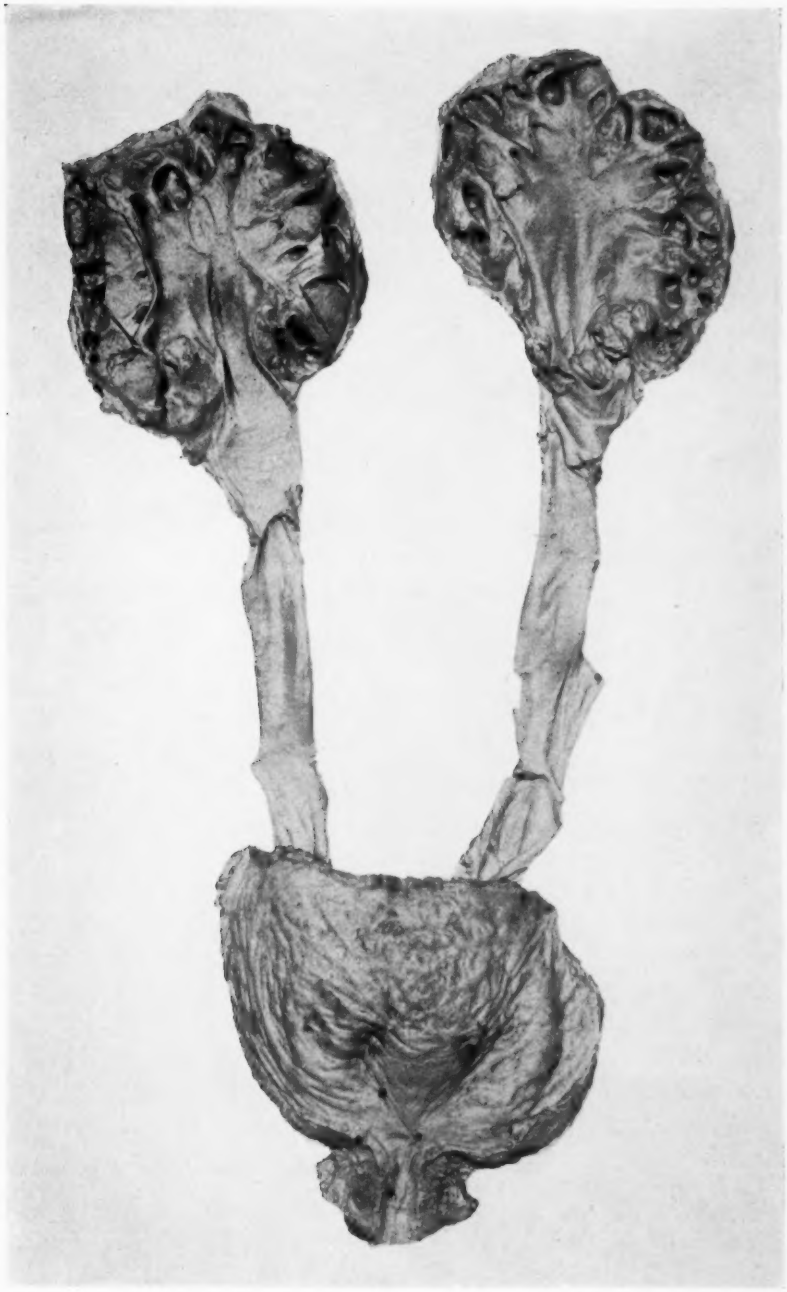

FIG. 3.—Note the crescentic area outlined by dots at the right of the apex of the trigonum, extending into the prostatic urethra to the right of the verum montanum, which is the area of incision of the Bottini operation. Note that the urethra on this side of the verum montanum is greater than on the left, and that the prostatic urethra is unobstructed throughout. Note the thickening of the bladder wall and pronounced surface markings. Note the dilatation of the ureters etc., hiding pelvices and calyces, and the small amount of renal parenchyma.

to consist of a series of peripherally arranged cavities 0.5 to 2 cm. in diameter, communicated with enormously dilated pelves. The surrounding parenchyma is very thin, averaging 1 to 3 mm. thick. The pyramids are atrophied and not demonstrable except in the lower pole of the right kidney, where the cavities are smaller. The capsules are much thickened, dense, white, about 0.5 mm. thick, and cannot be separated from the kidney. Both kidneys contain thin greenish yellow puriform material. The lining of the pelvis in places is thick, and injected, giving a velvety appearance.

Ureters.—Both are greatly dilated with much thickened walls. Circumference ranged from 3 to 4 cm. Both show ballooning just before entrance into the bladder. The left ureter leaves the pelvis of the kidney by a tortuous, S-shaped route. Ten cm. above the bladder orifice there is an obliquely placed constricting ridge, projecting into the lumen, reducing the circumference at this point to 2 cm. The right ureter, 20 cm. above the bladder orifice, on posterior wall, has a diverticulum running upwards for 2 cm. This recess has about the same calibre as the main lumen of the ureter, which is constricted here to about 2 cm. The wall between the ureter and recess is thick and on section appears as if formed from the fusion of the walls of adjacent limbs of a loop.

Bladder.—Contracted. Contains about 60 cc. of greenish yellow puriform material with abundant coagula. Walls are thick, trabeculated. Mucous membrane is folded, injected, velvety. Some greenish discoloration. Orifices of ureters are prominent and allow easy passage of probes. To the right of the apex of the trigonum is a crescentic cicatrix extending into the urethra.

Prostate.—Not large, rather flabby, prostatic urethra is large, lined with scar tissue continuous with cicatrix and bladder. The verum montanum is pushed to the left, and there are two parallel folds of mucous membrane running from it to the apex of the trigonum. The channel to the right of the verum montanum, that which is lined with smooth dense white tissue, is 3 cm. long. Below this the urethra is normal.

REMARKS.

The feature of this case which it is desirable to emphasize is the five repeated attacks of intermittent urinary retention associated with the relapses of the anæmia. Concurrent with the changes in the blood and weakness of the general muscular system the bladder wall has lost its contractile power and retention of urine has resulted. As the anæmia has improved and the muscle system has regained its tone the bladder symptoms have diminished and have even been absent. The retention has gradually improved with the patient's general strength

and between the anæmic attacks the bladder has been able to empty itself, except for a drachm or two.

Of course the changes in the upper urinary tract—the hypertrophy of the bladder wall, the dilatation of the uterus, kidney pelvices and calices, and the infection and destruction of the kidney tissue dependent upon the prolonged intermittent intravesical pressure—have still remained.

The case also illustrates the value of the Bottini operation in affording relief to prostatic obstruction by incising the obstructing portion of the gland in a class of cases which will not stand general anæsthesia or the shock and convalescence attending prostatectomy.

That the Bottini operation was of benefit in overcoming the obstruction in the prostate and that these changes in the upper urinary tract were not due to an obstruction to the outflow of the urine is evident from the fact that between the anæmic attacks the patient was able to start his urine easily, that it flowed freely in fair volume and that the bladder was emptied of its contents except for one or two drams.

The post-mortem specimen shows a patent prostatic urethra at the site of the operation, and demonstrates that the new channel made by the Bottini incision has not become, nor shows any tendency towards becoming obliterated during the three years time.

ARTHROPLASTY UPON THE ELBOW JOINT.

BY CHARLES L. SCUDDER, M.D.,

OF BOSTON, MASS.

Surgeon to the Massachusetts General Hospital.

THE following case illustrates the result of a plastic upon an ankylosed elbow joint one year and four months after the operation.

The patient was an adult man, 48 years old, a farmer and a carpenter by occupation.

The right olecranon was fractured by a fall from a wagon, April 21, 1905. There was at the time very great swelling about the elbow, and considerable displacement forward of the shaft of the ulna. The arm was extended, and covered with wet compresses for eight days. On April 29 the joint was opened through a posterior incision by the attending physician. Three fragments of bone were removed from the joint. An attempt was then made to wire the remaining fragment of the olecranon to the shaft of the ulna. Primary union followed in the superficial parts. The arm was immobilized for two weeks, and then gentle motion was begun. A few days later crepitus was noticed in the region of the fracture. A radiograph was taken, which disclosed a broken wire and the separation of the fragment of the olecranon from the ulnar shaft.

At this time the patient first came under my observation, July 6, 1905.

The elbow joint was almost completely ankylosed at an obtuse angle. There was a little movement possible, both actively and passively at the elbow joint, about 5 degrees.

In July, 1905, I did an arthroplasty upon the elbow joint by the following technique:

Steps in the operation of arthroplasty: Exposure of the joint by section of the olecranon; preparation of the joint and bony surfaces; making the fascial-fat flap; placing of the flap; suture of the olecranon fragment; closure of the joint; immobilization.

A long posterior incision was made, dividing all structures to the fascia, excepting that at that part of the incision over the back of the upper arm only the subcutaneous fat tissue was exposed. The olecranon was separated from the shaft of the ulna at the original point of fracture. Sharp flexion of the elbow exposed the joint surfaces, whereupon all adventitious bony and periosteal tissue was removed. The synovial membrane of the joint was thoroughly excised, a small bit of bone from the tip of the coronoid process was removed, and the ends of the bones were thoroughly freed.

The skin over the back of the upper arm was reflected laterally the whole length of the incision. A rectangular flap was then taken from the posterior surface of the upper arm, about three inches wide and five or six inches long, which included the fascia of the upper arm together with a small amount of subcutaneous fat tissue left when reflecting the skin flaps in the primary incision. When this flap was reflected the muscles of the back of the forearm were completely exposed. The pedicle of this flap was attached just above the posterior surface of the elbow joint.

The flap was rotated and swung into the joint, and placed between the ends of the exposed bones. The flap covered the lower end of the humerus, and the sigmoid cavity of the ulna and the upper end of the radius. The flap was held in position by a few interrupted sutures to the farther side of the joint.

The olecranon fracture was sutured by aluminum bronze wire. The fascia and ligaments about the joint were approximated so as to completely close the joint. The subcutaneous tissues were closed by interrupted sutures. The skin was sutured with silk worm gut. The wound was not drained. The arm was fixed at a right angle by an internal angular splint. Gentle passive motion was given at the end of about ten days.

At the present time, one year and four months following the operation, the man has a strong and useful arm, with which he is able to do all the work about a small farm.

The amount of movement at the elbow joint is seen in the accompanying photographs. Figs. 1 and 2 show the amount of motion three months following the operation. Figs. 3 and 4 show the amount of movement at the present time, one year and four months after the arthroplasty. In Figs. 3 and 4 is also illus-

FIG. 1.—Voluntary extension three months after operation.

FIG. 2.—Arthroplasty. Voluntary flexion three months after operation.

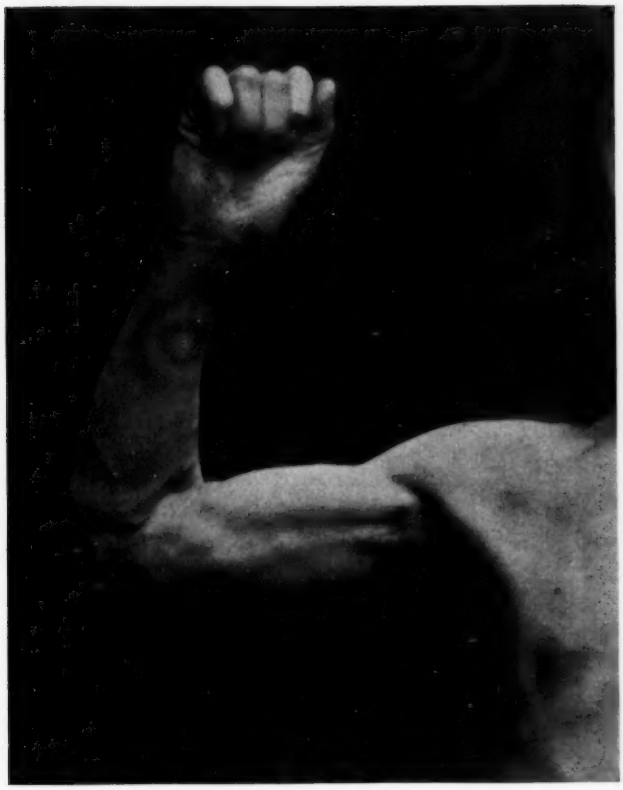

FIG. 3.—Arthroplasty. Voluntary flexion one year four months after operation. Note flexion of fingers.

FIG. 4.—Arthroplasty. Voluntary extension one year four months after operation. Note extension of fingers.

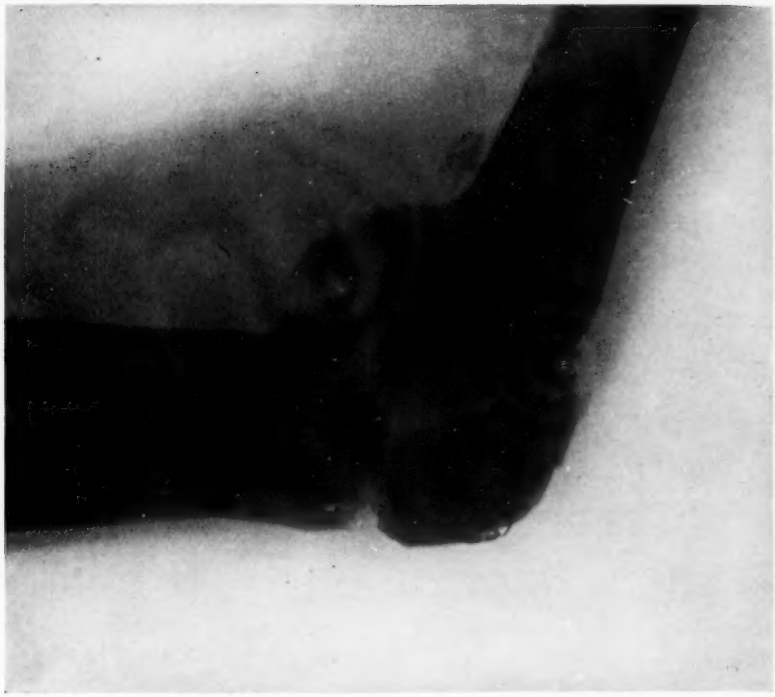

FIG. 5.—Arthroplasty. X-ray taken one year after operation. Note the line of section of olecranon to render easy access to joint. Note clear space corresponding to new elbow joint. Olecranon is solidly united to shaft of ulna.

trated the amount of flexion and extension of the fingers. Slight pronation and supination are possible.

The elbow does not trouble the man excepting for the small amount of limitation of motion. He has no pain and no discomfort with the joint locally that is of any importance. During wet weather there is a little feeling of discomfort about the joint, which he attributes to " rheumatism."

Fig. 5 shows the conditions as determined by the X-ray taken one year after operation. The olecranon process has united firmly to the shaft of the ulna by bony union; the wire is seen in place. It is broken at one point. The clear space of the joint is to be especially noted.

X-ray pictures taken previously to this one were not suitable for reproduction, but compared with this plate it is certain that there is no new formation of bone going on about the joint. The possible motion in the joint has not diminished since the first. Therefore it is reasonable to suppose that we have to-day in this case the final functional result of the operation.

There are certain facts of interest in connection with this operation of arthroplasty upon the elbow joint.

An ample incision greatly facilitates the operation. By section of the olecranon the exposure of the joint is easy, and the insertion of the triceps tendon is preserved intact. Consequently, after operation extension of the forearm is possible. The normal strength of extension is also maintained.

In the usual operation by a median posterior incision for complete excision of the elbow joint the power of extension is lost, or at most is very weak.

It is important, as Murphy of Chicago has pointed out, to clear the joint thoroughly of all adventitious tissue, as well as of any synovial membrane remaining. In a joint opened by the above method, in which the wound is closed by layer suture, there is no abnormal lateral mobility, no wobbling.

Murphy has found that the leaving of a thin layer of fat tissue attached to the fascia, to be used for the flap, is advantageous in the formation of a new joint.

The temporo-maxillary joint, the elbow joint, and the hip

joint are best suited to this form of plastic surgery. This procedure is best avoided in elderly individuals. It is adapted to the joints of children and young adults.

Persistence in passive and active movements after operation is essential to securing the greatest possible motion in a new joint formed by arthroplasty.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, November 28, 1906.

The President, Dr. George Woolsey, in the Chair.

CONGENITAL LUMBAR HERNIA THROUGH THE TRIANGLE OF PETIT.

Dr. Charles N. Dowd read a paper with the above title, for which see page 245.

Dr. John F. Erdmann said that about four years ago he saw two cases of congenital lumbar hernia, both on the left side, and both quite typical. The first patient, a child of two years, was lost sight of. The second, a child of four years, was operated on by Dr. Erdmann. The hernial protrusion was through the triangle of Petit, and no difficulty was encountered in closing the defect by bringing together the latissimus dorsi and the external oblique muscles.

CYSTS OF THE SUPRARENAL BODIES.

Dr. Andrew J. McCosh read a paper with the above title.

Dr. Charles H. Peck said the possible extension of these suprarenal cysts upwards, and their pressure against the wall of the diaphragm, to which Dr. McCosh had referred in his paper, recalled a case which came under his observation last summer. In that instance there was an extremely large cyst, filling the upper left quadrant of the abdomen. It was firmly adherent to the surrounding structures, and while the supposition at the time of operating was that it sprang from the pancreas, it might have had its origin in the left suprarenal, although its surface did not present the orange colored spots which Dr. McCosh men-

tioned as indicative of suprarenal cysts. An attempt to enucleate the cysts was abandoned when it was found that it had invaded the right thoracic cavity, passing beneath the ligamentum arcuatum internum. The entire hand, with the exception of the thumb, could be inserted into the opening beneath this ligament into the thoracic cavity, barely reaching the upper limit of the cyst, which compressed the lung and parietal pleura.

The cyst was emptied and drained, the patient made a good recovery from the operation and was well the last time Dr. Peck saw her.

ADVANTAGE OF THE LATERAL POSITION IN CERTAIN OPERATIVE PROCEDURES.

Dr. F. Tilden Brown demonstrated a folding-board which he had found very useful for the purpose of obtaining a satisfactory exposure of the iliocostal space in operations on the kidney and prostate with the patient in the lateral position. He also emphasized the importance of relieving the patient's chest from the pressure of the overlying arm during narcosis, and showed an upright upon which the arm could be suspended.

Dr. F. Kammerer said he also had found the lateral position of great advantage in difficult nephrectomies. To prevent turning over on the abdomen or on the back the speaker usually had the pelvis of the patient firmly held by a nurse seated at the lower end of the operating table. Of course the sound side had to be supported by some firm pillows or some device similar to the one shown by Dr. Brown. Speaking of position Dr. Kammerer said that he had had a rather disagreeable experience last spring with a patient on her abdomen over the customary inflated rubber pillow, Dr. Thos. L. Bennett administering the anæsthetic. The operation of nephrectomy had been underway for about 10 minutes when the pulse rather suddenly became weak and rapid, going as high as 180 a minute. The condition of the patient became critical and, at Dr. Bennett's suggestion, the position was changed to the lateral and the pillow removed. The condition immediately improved and the pulse in several minutes dropped to 120.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held November 5, 1906.

The President, Dr. John B. Roberts, in the Chair.

LAMINECTOMY FOR TUBERCULOSIS OF THE SPINE.

Dr. James K. Young presented a girl, 14 years of age, who, on February 7, 1902, fell on the ice, striking the dorsal region against a step. Two months later, she was sent by her attending physician to the Orthopædic Hospital and a brace was applied. In the spring of 1903 she was admitted to the University Hospital for beginning loss of power in the lower limbs. Subsequently she was admitted to St. Joseph's Hospital and to the Polyclinic Hospital. In January, 1906, she was admitted to St. Joseph's Hospital under his care, and he performed a laminectomy the day following her admission. Throughout all this time from the date of the accident to the time of operation her condition had progressed steadily worse, with slight intervals of improvement. The 8th, 9th, and 10th vertebræ were involved; there was a marked kyphosis, and paraplegia came on early and was intermittent, but steadily growing increasingly worse. Fourteen months before the operation her limbs became spastic and she had exaggerated knee jerks, marked ankleklonus, and Babinsky reflexes on both sides, with at times crossed reflexes. There was still some motor power. The following month, November, 1904, she could walk around the bed holding on for support, but rather awkwardly. One week later she could walk alone, and there was great improvement.

She again relapsed after this, and in April, 1905, upon her admission to the Polyclinic Hospital, she was completely paralyzed

and there was slight incontinence. In July, 1905, there was complete motor paralysis with slight incontinence which increased until at the time of the operation there was complete incontinence and complete motor and sensory paralysis.

On January 19, 1906, an incision five inches long was made from the third to the eleventh vertebra, the spinous processes of the ninth and tenth vertebræ were removed, and the lamina of the ninth vertebra was removed. An abscess was found beneath this on the right side which was opened and drained. A catgut drain was inserted and the wound closed, except for the drainage.

On February 26 the sensation in the lower extremities was slightly delayed but was present on both sides, and slightly hyperesthetic. The patellar reflexes were exaggerated, ankleklonus was present on both sides, the left more marked, and Babinsky reflexes were present on both sides and were marked. There was some contraction of the right knee at this time. Thermal sensation was diminished.

She was treated with electricity and massage and sent to the seashore. The motor power has gradually improved, the abscess has closed, and she is now able to walk a short distance unassisted, and has regained perfect control of the bladder and rectum.

Dr. Young said that two points were illustrated by this case, first, the diagnosis of abscess by the intermission of symptoms, improvement and relapses; second, the possibility of recovery by means of the operation of laminectomy after complete loss of motion and sensation.

He did not share the ultra-conservative opinion expressed by some surgeons in regard to laminectomy, but believed that under certain conditions this operation is a justifiable one. For abscess pressing upon the cord and for early spastic contractions of the extremities he believed the operation should be performed earlier than is customary.

Dr. Henry R. Wharton said the case reported by Dr. Young was eminently one for laminectomy, the presence of an abscess in the spinal canal showing that the patient's condition was hopeless without operation. Simple rest in some cases of Pott's disease results in restoration of motion and practical recovery, but in others laminectomy is the only alternative. The diagnosis of abscess is difficult; as pointed out by Dr. Young, intermissions in improvement are a valuable sign in this respect.

FIG. 1.—Double lower lip.

DR. YOUNG, in closing, said the crossed Babinsky reflex was the unusual feature of the case. Usually this sign is present on one or both sides. Here it was present on both sides and irritation of one foot caused the reflex on the opposite side.

TRUE DOUBLE LOWER LIP.

DR. JOHN B. ROBERTS presented a patient upon whom he had operated for the removal of a true second lower lip. The photograph (Fig. 1), taken before operation, showed the double lip to consist of a thick outer lip and a thinner internal structure separated from the outer by a deep fossa lined with mucous membrane. In the median line of the mouth the two lips were fused together at the vermilion border and downward to the attachment of the structure to the alveolar portion of the mandible. The inner lip was dissectetd from the outer and encised. The raw surface was then covered by drawing flaps of mucous membrane over it. The patient's curious anomaly was corrected and his appearance much improved.

EXCISION OF HALF OF THE LOWER JAW AND HALF OF THE TONGUE FOR EPITHELIOMA.

DR. H. S. CARMANY exhibited, by invitation, a patient on whom he had operated one year previously for carcinoma of the tongue and jaw. The disease was of three months duration, and extended from the under surface of the tongue to the alveolar process of the inferior maxilla on the right side, and from a little beyond the median line to the last molar tooth. It was painful and growing rapidly, and the cervical glands were enlarging on the same side. Dr. Carmany excised the lower jaw on the right side from just below the sigmoid notch to a point a little beyond the median line, and with it the right half of the tongue, the submaxillary gland and a few small cervical lymph glands. The wound healed kindly, and the man has remained in good health. Dr. Carmany asked the opinion of the Fellows as to the advisability of applying a dental splint in these cases.

DR. CHARLES F. NASSAU said that one should never operate on carcinoma of the lower lip, tongue or jaw without taking out the glands of the neck. Twelve years ago Dr. Nassau operated in this manner upon two patients and five years afterward both were still free from recurrence. In any extensive growth of the

jaw there is almost surely infection of the neighboring glands before they are palpable. Their removal is just as necessary as in connection with carcinoma in other portions of the body where the lymph channels are followed in the dissection. In Dr. Carmany's case life has undoubtedly thus been prolonged.

Dr. Charles H. Frazier said, in response to Dr. Carmany's inquiry regarding the use of dental splints in connection with partial resections of the lower jaw, that it had been his habit in his clinic at the University Hospital, always to consult a dentist prior to the operation. Dr. Cryer or one of his assistants had always been kind enough to examine the case before the operation and construct a temporary splint, which was applied at the completion of the operation. A permanent splint in the meantime may be made and adjusted after the wound is healed. By adopting this method the disfigurement accompanying the removal of the lower jaw may be largely, if not altogether avoided.

Dr. John B. Roberts said that he had seen a case of this kind in which Dr. McBurney had a dental appliance made before operation. It was held in place by a spring and fitted so well there was almost no deformity of the part.

RUPTURE OF THE KIDNEY.

Dr. Morris Booth Miller, by invitation, reported the history of a man of 31, a special officer of the B. & O. Railroad, who while chasing thieves fell, striking on his left side over the lower rib. He walked a distance of fifty feet before feeling faint. He then passed by urethra what appeared to be at least a quart of blood and twenty minutes later a second quantity containing many clots. While on his way to the Polyclinic Hospital on a street car he was obliged to leave the car and again pass blood and urine. He walked into the hospital where six ounces of blood were withdrawn by catheter. Dr. Miller saw the man one and one-half hours later. There was no shock but the side was rigid and tender and an indistinct dull mass could be felt in the loin. An oblique lumbar incision was made. A mass the size of two fists was revealed and opened, showing extensive hæmorrhage and rupture of the kidney. The two poles were separated and the finger could be passed between numerous small fragments into which the middle segment of the organ had been divided. This caused severe bleeding. Wicks of gauze

were placed against the kidney in front and behind, and by pressure the poles were brought approximately together The patient did well, hæmorrhage practically ceasing in five days though at two later periods blood appeared in the urine. The amount of urine passed was at first 22 ounces but soon rose to 30 and then to 40 ounces. On the seventh day the wound dressings showed the presence of urine which then leaked through the back for a period of two weeks, the quantity being estimated at 20 ounces a day. On the twelfth day the packing was all removed and the opening finally healed. Suppuration was not present in the wound at any time. The temperature chart of the patient shows three rather sudden rises, probably due to cystitis as the bladder was frequently washed.

Dr. Henry R. Wharton stated as his personal experience that conservative surgery of an injured kidney is good surgery. He knows of several cases in which there were symptoms of ruptured kidney, including hæmorrhage from the urethra and a mass in the side, and the majority recovered. Another class of cases is formed by those in which infection occurs and abscesses form in the loin or abdominal cavity. He has also seen several of this type in which urinary fistula followed opening of the abscesses, but these sinuses all closed spontaneously.

Dr. Charles F. Nassau agreed with Dr. Wharton that it is not always necessary to operate on a ruptured kidney; this accident is probably more frequent than generally alleged. One patient, a woman, undoubtedly had a severe kidney injury, as shown by a mass in the loin and bloody urine for several days. She recovered. A second case was seen in the absence of a hospital colleague and would have been subjected to operation had he not been going to return soon. The colleague waited and did not operate for ten days. By that time the patient had bled so much he died when under operation. Some days ago a man was kicked in the back by a horse, the injury being followed by hæmaturia with free blood in the abdominal cavity, as clearly shown by physical signs. The pulse increased rapidly and the abdomen was opened. A rent in the liver four inches long was found, but in addition there was blood behind the peritoneum and the kidney was found torn in half and absolutely loose from all surrounding structures. The kidney was removed and the man did well. He passed 35 ounces of urine on the third day.

He then developed pneumonia and died in two days. If in cases of kidney injury hæmorrhage continues and other conditions do not prevent it, an incision into the loin is indicated. This has not even the danger of an abdominal section and will at least get rid of a hæmatoma which might otherwise become infected.

Dr. John B. Roberts described the case of a boy of 10 or 12 who was run over by a wagon, the wheel passing over his abdomen. He was brought to the Polyclinic Hospital where nothing definite regarding his condition could be determined. There was pain in the abdomen as though due to local peritonitis but the abdomen was not opened. In two weeks all symptoms had disappeared and the boy was discharged. Two or three weeks afterward he came in with an enormous bulging mass in the right side which was dull and tender. An incision gave vent to limpid fluid and it was supposed that there had been rupture of a ureter or that a traumatic hydronephrosis had been tapped. Examination of the fluid led to the report by the pathologist that it was from a cyst of the pancreas. This appeared to the operator to be unlikely. Later the fluid that came from the drainage tube was examined and reported to be urine. Dr. Roberts does not know whther the fluid first obtained actually came from the pancreas and the later drainage from the urinary tract or not; but the boy recovered and is now perfectly well.

Dr. Francis T. Stewart regards the time before operation as the proper time for conservatism. If operation be necessary, radical procedure is then probably the best, as often the kidney will be found badly injured and had better be removed, although, of course, one must be guided by the conditions found. The dangers are hæmorrhage and sepsis. The two early indications for operation are a progressively increasing hæmatoma and constitutional symptoms of hæmorrhage. Usually these two go together. Sepsis is at times a later indication. Hæmaturia is not necessarily an indication for operation. His chief difficulty has been to make a correct diagnosis. In one case, that of a man injured by a crush, a large amount of blood was passed by the urethra, the abdomen was rigid and there was marked shock. Rupture of the bladder was suspected by Dr. Gibbon who also saw the case and Dr. Stewart believed the condition to be a rupture of the kidney. Incision revealed intact kidneys and bladder and a ruptured liver. In this case, although the man

died of hæmorrhage from the liver, the pulse never rose above 100, though it was very weak. In another case, secondary hæmorrhage after an abdominal operation, a large quantity of blood was passed by the urethra though there had been no injury of the bladder, ureter, or kidney. A third case was that of a boy who had been kicked in the abdomen. The symptoms were those of an intraperitoned lesion and no blood was found in the urine. Operation revealed no injury to the abdominal viscera but a ruptured kidney. The kidney was removed and the case terminated satisfactorily. In several cases of moderate bleeding he has operated and afterward been sorry that he had interfered.

Dr. John H. Gibbon said he saw the man referred to by Dr. Stewart and because of blood passed by the urethra regarded the case as one of probable rupture of the bladder. He agrees with Dr. Stewart as to conservatism in cases of injury of the kidney when hæmorrhage is not sufficiently severe to cause death. He does not agree with the statement that hæmorrhage severe enough to demand operation usually means an injury sufficiently extensive to require nephrectomy. The question of nephrectomy must be decided when the kidney is exposed. If the rupture extends into the pelvis of the organ and implicates large vessels the kidney should be removed. He has seen cases in which one-third of the kidney was separated from the remainder of the organ by blood clot terminate in good recovery after removal of the clot and insertion of packing. If suppuration does not occur in such cases one has a right to believe that function of the kidney has been restored. Removal of a kidney is so easily done that some are removed when nephrectomy is not demanded; this is also true of the spleen. Dr. Gibbon believes that a kidney which shows numerous lacerations, as did the one in Dr. Miller's case, is easier to save than is one containing a single large rent. A good working rule in rupture of the kidney is that if the bleeding can be controlled the kidney should not be removed.

Dr. Miller, in closing, said the justification for immediate operation in the case reported was the hemorrhage. Often in these cases if the surgeon waits he loses the favorable moment for operation. Dr. Miller agrees with Dr. Gibbon that only when the kidney is exposed can the surgeon determine what is the wisest procedure. In his case he decided that barring anuria or later suppuration the man might get well with a functionating

kidney. It is to be remembered in deciding these cases that the patient has only two kidneys and if one be removed, loss of the other means death. So far as nephrectomy is concerned, the ruptured kidney in his case could have been removed with probably only slightly increased risk to the patient.

SARCOMA ORIGINATING IN THE ISCHIO-RECTAL FOSSA.

DR. GEO. ERETY SHOEMAKER said that sarcomatous growths may be found at widely distributed points in the body, as they may occur wherever there is a connective tissue. It is, however, unusual to find them situated in the ischio-rectal fossa. Sarcomata are from time to time reported in the pelvis, behind the peritoneum, involving uterus or ovary, intestine, sacrum or one of the iliac bones in the pelvic basin, but such cursory search of indices and such inquiry among surgeons as he had been able to make would indicate that the perineal or ischio-rectal region is a most unusual location for this form of tumor.

In a series of 54 cases of osteosarcoma of bones of the pelvis, collected by Havage*, there were none springing from the ischium or pubis and none in the ischio-rectal region. He now reported a case in which its early stage the differential diagnosis was difficult in comparison with a low grade of connective tissue inflammation. Careful observation, however, showed a continuous growth, a complete absence of tenderness, a discreet form, no tendency to involve the rectal wall and no tendency to point externally. On extirpation of the mass it proved to be a mixed type of sarcoma, with a small central area breaking down. The case was as follows:

A well developed, strong and vigorous girl of 21, a student in typical health, resident of Kansas. Family history negative, weight 118; tuberculosis in a maternal uncle and in a grandmother. Menstruation regular and normal, no history of injury of the part. One month before being referred by her physician a lump about the size of a walnut was noticed deep in the left perineum; aching, but with neither pain, tenderness nor throbbing. No history of discharge and none of constipation. Had been unusually well for a year. Examination showed superficially to the left of the rectum and vagina and behind a line drawn

*Tumors of the Pelvis. 1882.

FIG. 2.—Sarcoma of ischio-rectal fossa. Two-thirds normal size. Age 21.

from the posterior vaginal commissure to the tuberosity of the ischium, extending from the rectal wall out nearly to the ramus of the pubis and nearly to the tuber ischii, a mass three inches from front to back, two inches from right to left, against the rectal wall but not infiltrating it, firm, somewhat movable. No softening, no redness. The condition resembled a low grade of inflammation in the pararectal tissues but was too firm. As a definite increase in size occurred with a tendency to greater fixation, the diagnosis of tumor was made (Fig. 2).

An antero-posterior incision over the prominence was made 1¼ inches to the left of the median line, immediately opposite the center of the perineum. There was no true capsule and no sharply defined line between normal and new tissue. Small areas of hardening projected from the growth anteriorly toward the vulva. At no point was the skin or mucous membrane involved. One or two small tortuous subcutaneous veins were visible. The growth invaded all tissue up to the rectal and vaginal walls and between them and the tuber ischii including muscle and fat. Half an inch behind the edge of the ischium it appeared to be firmly attached. The fingers were used to enucleate the mass and by blunt dissection it was separated from the pubis and ischium. It did not appear to infiltrate or expose bone. A superficial portion of the sphincter ani was preserved and only the superficial portions of the left labium majus. The constrictor vagina on the left side was sacrificed and the erector clitoridis cut in two. Hæmorrhage was not severe. The trunk of the internal pubic was caught behind the tuber ischii, giving a comparatively dry field. The tumor removed was three inches in antero-posterior diameter, 2½ inches in lateral diameter and 2 inches from without inward. The deeper parts of the wound were partly drawn together with catgut and the skin united except at the center, where gauze drainage was applied. There was no secondary hæmorrhage. Marked œdema of the anterior portion of the genitalia developed, making catheterization very difficult. Union appeared at the end of the first week, except at the point of drainage. There was no lack of control of the sphincter ani, but complete anæsthesia of the rectum and vagina on one side from division of nerves. The rectum did not slough.

Microscopical examination of the growth in the Laboratory of the Presbyterian Hospital showed sarcoma of mixed type.

Although every vestige of visible or tangible disease was removed at the operation, recurrence was rapid locally and generally. The vulva and perineum of the left side were first invaded, the inguinal glands later. At the end of six months a mediastinal pressure is interfering with respiration and death is reported as imminent. Trypsin treatment has been used by her Kansas physician without benefit.

Dr. Charles F. Nassau cited a case seen three years ago which was similar to that of Dr. Shoemaker's, even to rapid recurrence and death. The patient was a young man sent to the hospital with the diagnosis of ischiorectal abscess. Suspecting malignacy, Dr. Nassau cut very wide of the lesion, taking everything to the tuberosity of the ischium. The tumor recurred in three months.

EXTREMELY VICIOUS UNION OF A FEMORAL FRACTURE SUCCESSFULLY TREATED BY OSTEOTOMY, NAILING AND VERTICAL TRACTION.

Dr. John B. Roberts showed skiagraphs of this case to illustrate, (1) an unusual displacement as the result of a fracture; (2) the result gained by the use of nails and traction, and (3) the unreliability of the X-rays. The patient was a child of three years who was thrown down in a field by a calf winding him in the coils of a rope. He was seen by Dr. Roberts at the end of eleven weeks, when the leg showed five inches shortening. Operation by Dr. Roberts showed that the femur had been fractured, the fragments crossing and also being twisted. There was solid union and great force was required to chisel apart the fragments. Contraction of the muscles could not be entirely overcome by pulling. The fragments were adjusted, but still overlapped; to prevent twisting again taking place, two fracture nails were driven into them; and horizontal traction applied by the ordinary method. At the end of a week the nails were withdrawn, the leg put in the vertical position and a weight applied to stretch the muscles. The leg is now straight, there is solid union and careful measurement shows a shortening of about one and one-half inches. The skiagraph taken shows what appears to be an overlapping of three inches. The Crookes tube was probably not carefully placed over the fracture when the exposure was made. The medical profession should now deprecate too great reliance on the

X-rays. Skiagraphs, taken as they usually are by a man who is not a surgeon and who does not know the case, are apt to lead to erroneous deductions. They may lead us into errors and should not be relied upon as much as people usually think.

Dr. George G. Ross agreed with Dr. Roberts as to the danger of the X-rays in fracture work; the picture is correct, but the interpretation is wrong. As corroboration of clinical diagnoses he has used many skiagraphs. He advises against having skiagraphs of results taken, as there may clinically and functionally be a satisfactory termination and yet the X-rays shows an amazing condition.

Dr. Roberts replying to a question as to how much was gained by traction upon the leg after removal of the nails, said that the nails were put in to prevent twisting, not overlapping, as he was afraid the original twist would recur. The nails were a temporary expedient to maintain apposition of the raw bone surfaces. As he thought that five days were sufficient to prevent twisting, the leg was then placed in the vertical position and traction with a weight and pulley applied. He does not know exactly how much was gained by this expedient but he felt that the operation had reduced the shortening from five to three inches. As the leg now is only one and one-half inches shorter than its fellow, he believes that he gained about three and one-half inches by the operation. There is, of course, the possibility that the legs were of unequal length before the fracture occurred.

BULLET WOUND PIERCING LUNG, DIAPHRAGM, AND THE SPLEEN.

Dr. R. P. McReynolds said gunshot wounds which penetrate the lungs, the diaphragm and some one or more of the abdominal viscera are not unusual but they are perhaps rare enough to justify the report of the following case which was seen in a private house in consultation with the attending physician, Dr. M. Graham Tull. A sixteen-year old boy attempted to shoot himself through the heart; but his knowledge of anatomy was not accurate and he missed his aim. The bullet entered the seventh interspace, mid-nipple line, ranged downward, passed through the diaphragm and came out posterior between the eleventh and twelfth ribs mid-scapular line.

Dr. McReynolds saw him within an hour of the accident;

he had some dyspnœa, and some pain, but on the whole his general condition was good; he was but little shocked and the external hæmorrhage had been insignificant. But from the range of the bullet, the rigidity of the abdominal muscles and a marked increase in the leukocytes an immediate operation was advised. He was hurried to the Presbyterian Hospital and under general anæsthesia the abdomen was opened high up through the left rectus muscle. The spleen was found to have been almost bisected by the bullet and was bleeding freely; none of the other abdominal organs were injured. An attempt to suture the wound in the spleen was made but failed and resort was had to tamponnage —the gauze being placed so as to approximate the edges of the wound and to stop the hæmorrhage. The usual after-treatment for such cases was instituted and wound healed by granulation.

From the thoracic wound a septic pneumonia developed from which a long and severe illness followed. However, he finally made a good recovery and now, two years after the injury, is strong and healthy.

Remarking upon this case Dr. McReynolds said that there are no early physical pathognomonic signs of internal hæmorrhage; prompt surgical action will however establish the diagnosis, and in the majority of cases give the patient the best chance for his life. In abdominal injuries requiring laparotomy, the rule " when in doubt operate at once " seems to be a good one. Penetrating wounds of the lung give a high mortality and the treatment of such cases is not altogether satisfactory. Dr. Rodman, in an excellent monograph on this subject, has very aptly summed it up in two words—" masterly inactivity." This is certainly the accepted treatment of all simple penetrating wounds of the thorax, such as usually occurs when the wound of entrance is above the sixth interspace. But if the wound is below this point and there is reason to believe the diaphragm has been punctured and the abdominal viscera injured, the modern tendency is towards masterly activity. Dr. Daniel H. Williams in an article published in the ANNALS OF SURGERY, November, 1904, advocates resection of a rib, suturing the rent in the diaphragm and following the wound to the end. The success in a number of cases so treated would seem to justify this procedure, especially in cases where there is no wound of exit and therefore an uncertainty about the injury to the abdominal viscera.

Statistics show that gunshot wounds of the spleen have been most always fatal, the majority of the cases dying from hæmorrhage and generally within twenty-four hours. In dealing with a splenic wound there may be a choice of several procedures, *i.e.,* Suturing with catgut and reenforcing by sewing the omentum over it. Tamponnage with strips of gauze. Splenectomy. Cauterization. The first two are the methods of election. It would seem that the ideal procedure would be to close the wound with catgut sutures and then reinforce by sewing the omentum over it.

The spleen was first sutured by Lamarchia in 1896; his patient promptly died from hæmorrhage (he did not sew the omentum over the wound). However, others have been more successful—there are in this country two and probably more cases reported of successful splenorrhaphy. Treatment by tamponnage has given very good results. Berger in exhaustive statistics covering one hundred and twenty-seven cases of splenic wounds from various causes treated by laparotomy records ten cases treated by tamponnage with only one death. Successful cases of ruptured spleen treated by this method have been reported by Gibbon, Brewster and others. Senn from extensive experiments upon dogs concludes that marginal compression of the wound by hæmostatic forceps should precede the introduction of the catgut sutures, claiming that the compression diminishes the hæmorrhage and permits of the more easy and successful introduction of the sutures.

If the spleen has been so extensively injured that it cannot be sutured and tamponnage will not control the hæmorrhage a splenectomy is indicated; but this materially adds to the danger. The kind of the operation performed is not of so much importance as the time when it is performed. He had seen two cases of rupture of the spleen and both lost their lives, he thought because they were not operated on early enough.

PHANTOM URETERAL CALCULI.

Dr. Francis T. Stewart exhibited X-ray plates which were made from a patient in whom Dr. Dwyer suspected ureteral calculus because of pain radiating from the iliac regions to the loins, and the passing of large numbers of uric acid crystals. No blood was found in the urine. The plate, taken by Dr.

Manges, shows shadows which at first were thought to be those of ureteral calculi. There were five on the left and two on the right side, one being large as a pea. More careful examination of the plate raised the suspicion that the shadows were not those of ureteral calculi, as the five on one side were not in perfect alignment and were outside the course of the ureter. Further investigation was decided upon and the bladder was inspected and both ureters catheterized, the latter appearing free. Both vaginal and rectal palpation, however, showed between the vagina and rectum extremely hard, apparently calcareous masses, five on one side, and two on the other. They were not excised, hence their nature is unknown, but they were thought to be phleboliths. Cystoscopy showed that the orifice of the right ureter was in the middle line and that of the left further to the side than normal, so the situation of shadows out of the usual line might in some cases be regarded as due to calculi in the ureter.

The diagnosis of ureteral calculi by the X-rays is not absolutely positive, whether shadows are or are not shown. In one case ureteral colic was felt on one side, but two X-ray plates proved negative. As there was a little blood in the urine and colic persisted it was concluded that the X-rays were wrong. Catheterization of the ureter showed no obstruction, but as no urine came through the catheter for ten hours salt solution was injected. Aspiration then brought away many uric acid crystals which may have caused the obstruction. Dr. DaCosta has reported a case of calcareous lymphatic gland supposed to be a ureteral calculus. He operated in this case upon a perforated gastric ulcer which was followed by a long-persisting sinus. Incision finally showed at the bottom of the sinus a fecal and calcareous concretion. It is not known if this mass came from the stomach. Foreign bodies in the intestine may deceive the skiagrapher, though careful operators see that the bowels are well opened before taking the picture.

Dr. John B. Roberts said the possibility of erroneous showing of the X-rays is an interesting topic. In one instance under his observation they did reveal that a resident physician was not giving his patient proper attention and reporting all that he should. The patient had diarrhœa and had been given bismuth by the resident without reporting the matter to the surgeon. A skiagraph, taken for a lesion of the hip, incidentally showed by

reason of the bismuth an impacted rectum, to which the diarrhœa was due.

Dr. Willis T. Manges, who had taken the skiagraphs exhibited by Dr. Stewart, said the X-ray makes no mistake but man makes the mistakes. Its character is shown by the fact that by it a foreign body in the eye or other part of the body can be localized and its position determined with absolute accuracy. The average hospital skiagrapher has too many cases to examine to do careful work. Dr. Manges has noticed in other cases shadows similar to those in Dr. Stewart's plates. In one case with symptoms referable to the genito-urinary tract, the kidney region showed no evidence of stone, but on skiagraphing the pelvis there was shown two or three small, perfectly round bodies on either side, apparently calcareous or other hard masses. These bodies in the pelvis have been noticed only in cases examined for calculi. At times it is difficult to distinguish them from calculi, but ureteral calculi are rarely found. Among the skiagraphs exhibited by Dr. Manges was one of a patient who had ureteral or renal colic. There was no tenderness of the ureters and catheterization showed no obstruction; there was no blood in the urine. Dr. Manges made the diagnosis of ureteral calculus. The patient refused operation and improved. He is undetermined as to the exact condition present. The shadows are in the position of ureteral calculi, but they are perfectly round. Now in such a case, instead of insisting on operation he would say that calculi were not present. In another case of renal colic, blood in the urine, tenderness, but no obstruction to the catheter, the skiagraph showed small shadows which were not round. Two weeks later the patient had another attack of colic and a skiagraph then showed no bodies. In still another case of Dr. Stewart's the skiagraph agreed with the clinical diagnosis, but the patient refused operation. One year later a skiagraph showed a ureteral calculus still present. There was no obstruction to a catheter though the calculus was large as the end of a finger. The question is what are the small perfectly round bodies in the pelvis at times in the position of calculi or at other times near the brim of the pelvis where they clearly are not calculi? Dr. Manges intends to experiment upon cadavers for the purpose of determining what these bodies are.

Dr. John H. Gibbon, referring to the case mentioned by

Dr. Manges in which skiagraphs were taken one year apart, said he examined three plates, each showing the presence of a body. Clinically there were attacks of renal colic. A catheter was passed, but that does not rule out the diagnosis of ureteral calculus, as he believes it possible to pass a catheter when a calculus is present. He believes the man has a calculus. Dr. Gibbon showed two plates, one of a case of ureteral calculus and one in which none was present. The one proved to be no calculus though there was blood in the urine and tenderness over the ureter. The skiagraph shows what appears to be a large stone. The case was very deceptive, but after going over it several times the diagnosis of stone was made. When the abdomen was opened there was found a large hard body, but it was situated in the broad ligament instead of in the ureter. When removing it the mass ruptured, allowing the escape of material resembling white lead. The capsule was tense and it was finally decided the mass was tuberculous. The pathologist has not yet given an opinion as to its nature. This body had cast a shadow in the position of the ureter. The plate that does show a calculus was made from the patient from whom Dr. Gibbon removed the large cystic kidney shown at the previous meeting of the Academy. The calculus was removed by the extraperitoneal method. The patient is making a good recovery.

Dr. George Erety Shoemaker said he frequently turns phleboliths out of the pelvic veins during operations upon women. He has seen a loose calcareous body the size of a pigeon egg free in the peritoneum. Very small dense masses of dermoid material must also be reckoned with forming either the whole or part of dermoid tumors. He has seen one entire dermoid the size of a bantam's egg and one smaller. In one girl a calcareous mass was found against the bladder on the peritoneal side. Cheesy bodies in the pelvis are common. That day he had with difficulty turned out back of the broad ligament a sac with thick organized wall and cheesy contents resembling an ovary. This mass was the result of inflammatory and retrograde changes and would have given an X-ray picture in the line of the ureter.

Dr. Kelly, who examined the bodies removed from the frimbria by Dr. Stewart, said there were five bodies about twice the size of the head of a pin and were round and smooth. They were composed of fibrin with calcareous material in the center.

DR. STEWART, in closing, said that in addition to phleboliths, foreign bodies in the intestine, calcareous glands, defective X-ray plates and dermoids, two other conditions are to be remembered in this connection. First, atheromatous plates in a blood vessel. Second, small, hard, calcareous masses in the end of the Fallopian tubes. The latter seem to be composed of fibrin and calcareous matter. During the past week he found several calcareous masses of this character apparently spring from the fimbriæ of the tubes. These were in the line of the ureter and would have suggested ureteral calculi had an X-ray plate been made.

CORRESPONDENCE.

BONE METASTASES OF HYPERNEPHROMA.

EDITOR ANNALS OF SURGERY:

I wish to add to the paper upon the "Bone Metastases of Hypernephroma," which appeared in the December, 1906, ANNALS OF SURGERY, the following two cases of bone metastases, which were accidentally omitted from the cases then reported.

CASE I.—"Report of a Case of Malignant Hypernephroma, with Metastatic Growths in the Bones and Two Spontaneous Fractures of the Femur." E. R. LeCount. Trans. of the Pathological Society (Chicago), 1902, V, p. 82.

CASE II.—"Hypernephroma of the Kidney with a Metastatic Growth in the Superior Maxilla." E. R. LeCount. Trans. of the Pathological Society (Chicago), 1905, VI, p. 373.

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